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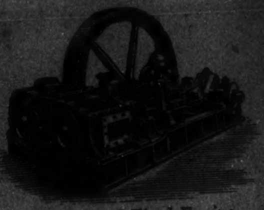

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THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XV.—NO. 362.

INCANDESCENCE ELECTRIC LAMPS.

RECENT improvements in the manufacture of incandescence lamps have very much reduced the consumption of electrical energy, which was, say two years since, necessary for the production of a given candle power.

For a lamp giving an illuminating power equal to 20 standard candles, it is claimed that for this type of lamp, which appears to be the one most generally employed, only 2½ watts per candle power are required.

We need not say how important this is in the more economical production of the electric light, but we would ask whether the carbon filaments of such lamps are as long lived as those older loops which demanded a greater expenditure of electrical energy to obtain a given result.

It has recently been brought to our notice that in several installations in which a well-known incandescence lamp has been used, the number of filaments which have given way after a few weeks use is quite appalling, although the lamps were worked at an electromotive force some 5 or 6 per cent. lower than they were intended for.

The question, then, is whether the economy in the current strength is not more than counterbalanced by the increased expenditure for new lamps.

It is a very noticeable fact that in the Edison system the lamps appear to be in much the same condition, as regards consumption of electrical energy, as they were several years ago, and for a light of 16 candles more current is required than is used in some other lamps for the production of 20 candle power. On the other hand, it is very evident that the comparatively low state of incandescence of the Edison filaments is conducive to long life. Which system then is the more economical in the long run, that in which the electrical energy is reduced to 2½ watts per candle power with a probable duration of 400 to 500 hours, or even less, as the life of the lamp, or that demanding 3½ to 4 watts per candle power with a certainty of the lamp lasting over 1,000 hours ?

The cost of incandescence lamps is not so small as to be overlooked as an item in the working expenses of an electric lighting installation ; indeed, at the present prices any excessive number of failures forms a most serious consideration.

We have brought this matter forward with a view of obtaining, if possible, some degree of information for our readers as to whether the structure of the filament has been sufficiently investigated by the manufacturers of incandescence lamps from the long life point of view.

Unless the filaments can be made to last, when taking 2½ watts per candle power, as many hours as they did before the reduction of current strength formerly necessary to produce a certain luminosity, the value of the latest improvements must be somewhat discounted.

Some statistician with time at his command might compile a most interesting set of figures on the points enumerated above ; certainly results of practical value to the consumer, at least, might be tabulated.

THE PHILADELPHIA ELECTRICAL EXHIBITION.

SECOND NOTICE.

THE Exhibition has, in every respect, been quite successful, and has more than paid its cost. It was open thirty-four days, and was visited by 300,000 persons. During the last week the attendance averaged 14,000 daily, the largest being on the Thursday, when 16,624 passed the turnstiles, and the smallest during the Exhibition was on September 25th, when the weather was intensely hot, and the attendance was only 2,658. The receipts amounted to $100,000 ; and $90,000 having been spent in general expenses, $10,000 profit remains.

Glass, Dr. James, of the Excelsior Works, Philadelphia, exhibited three cases of medical batteries with resistance coils, designed for the use of visiting-physicians.

Goodwin, F. O., of Philadelphia, displayed various styles of conductors for the protection of buildings against lightning, and fifteen different designs of points for same, including one by Professor Houston.

Haase, Robert, of New York, had also a medical battery of sufficient power for ordinary purposes, so small as to admit of being carried easily in the vest pocket. The cell measures 6 by 1½th inches ; carbon and zinc are the electrodes used, and a small induction coil, &c., are made to use with it.

Hanson, Van Winkle & Co., of Newark, N. J., exhibited a small dynamo for electro-plating purposes, anodes of nickel, &c.

Hartman, J., of Philadelphia, also showed electroplating plant.

McGrory, Thos., of Philadelphia, exhibited some of his insulators, which are of peculiar form, as shown by fig. 7. The inventor claims for them that when once the wire is pushed into its place it can neither slip nor strain out. He also claims that one man can put up as many wires on this system as two can by tying or wrapping ; and that it saves from 14 to 18 inches of wire per insulator. We do not, however, think that this insulator will commend itself to English electricians for many reasons.

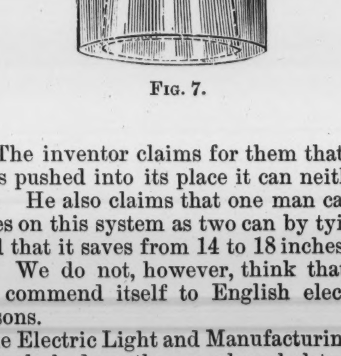


FIG. 7.

McTighe Electric Light and Manufacturing Company, of Pittsburgh, had a rather poorly upholstered room lit by electric lamps; also dynamos and lamps. For description of the McTighe generator see ELECTRICAL REVIEW of the 13th of September last.

Milwaukee Electric Manufacturing Company, of Milwaukee, displayed electro-pneumatic apparatus with thermostat and battery attached for application to steam-heating purposes, so that the steam valve and the radiator is operated by the temperature. An apparatus on the same principle was shown for application to signalling and other operations.

Moore, A. F., of Philadelphia exhibited insulated wires.

National Time-Regulating Company, of Boston, had on show the Oram telephone standard time repeater. The object of this instrument is to give to every telephone subscriber an opportunity to know the exact standard time at any moment by simply taking down his receiver and holding it to his ear. One instrument only will be required for each exchange, it being connected into all the circuits through the ground wire at the back of the switch-board. The cost to each subscriber has been fixed by the company at one dollar per year. The operation of the machine is as follows: During every minute of the day, and exactly on the minute, a special signal from a standard clock is sent over all the lines that are to receive the time. This signal is easily distinguished, and, on account of its peculiar sound, it is called the "buzz." By mechanism, hereafter to be described, this machine strikes out the exact hour and minute at which each buzz occurs. Thus a subscriber, wishing to set his timepiece, has simply to take down his telephone and put it to his ear. Presently he hears, ticked out in a manner very similar to the fire alarm, two blows, and, after a short interval, he hears three blows, soon followed by five blows. This means that when the next buzz comes it will be exactly two o'clock and thirty-five minutes. A more detailed working of the machine may be seen by referring to the engraving, fig. 8. A is an open circuit relay, the coils of which are connected through a battery with a circuit-closing device on the arbor of the second wheel of a clock, which may be located at any distance from the machine. The points, B and C, form the local contacts of the relay. C is connected to the ground wire of the exchange, which has been disconnected from the earth. B is connected to earth through a battery of about one cell for every one hundred lines. The hammer, T, is connected to earth through the same battery that leads to B, and the contact point under the hammer is connected with point C. Thus closing the circuit through B, C, or through T, will send a current through all the lines connected with C. The point, C, is on a light spring attached to the armature of the relay, so that, when brought up suddenly before the point B, there is for an instant a vibrating contact at exactly sixty seconds of every minute. The circuit through the relay is closed at the clock, thus connecting the points B and C, which send a vibrating signal through all the lines connected with C. This signal is readily recognised as the buzz. The relay, A, in addition to sending the special minute signal, controls the striking mechanism, which operates as follows: D is an electromotor, which revolves continuously at a high speed, and at regular intervals is made to revolve the repeating cylinder, F, through the diminishing train, E. The cylinder, F, is provided with three sets of teeth, one set consisting of twelve rows to strike the hours. The next consists of five rows to strike the tens of minutes, and another set, composed of nine rows, to strike the minutes. In front of the cylinder are three toothed racks, capable of a sliding motion in a direction parallel to the axis of the repeating cylinder. Each rack corresponds to a set of teeth on the cylinder, and is provided with a lever, which, when acted upon by the teeth of the cylinder, trips the hammer, T, and closes the circuit at S, which is normally held open by a spring on the under side of T. When the relay is actuated by the minute signal from the clock, the motor is made to engage the train, E, by means of the arms, G, H, and the pulley, L, which is provided with a clutch, and thus the cylinder is caused slowly to revolve. In its revolution the teeth on its surface trip the hammer, T, a number of times corresponding to the hour and minute of the day. Each revolution of the cylinder causes a change in the position of the racks, O, P, Q, in readiness to strike out the next minute. These racks are shifted by a spring cam (not shown in the cut) at the right of cylinder, which plays into the notches on their upper edge. The minute rack, Q, moves one notch a minute, and when it has reached the tenth minute it is withdrawn by a spring, and the cam moves the ten minute rack, which, in its turn, allows the cam to move the hour rack, which moves once an hour. When the cylinder has completed a revolution, the motor is automatically thrown off by means of the hooked arms, K, being forced by the spring, M, into a slot in a disc on the shaft of the cylinder, a part of which may be seen at N. In the early experiments it was found that, if only a portion of the lines in an exchange were connected with the time transmitter on nearly all the

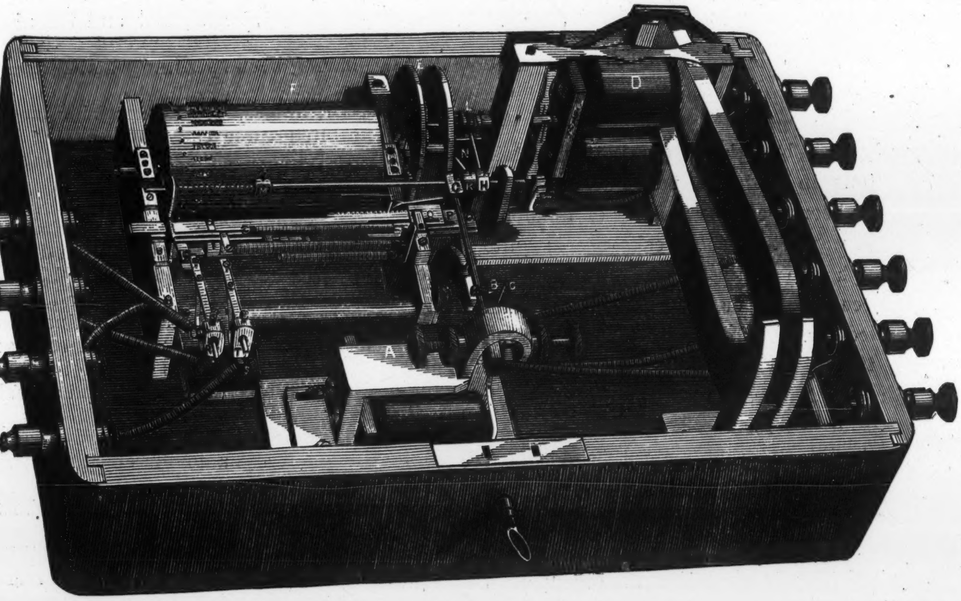


FIG. 8.

other lines which ran near them or through the same cables, the time signals could be read by induction or leakage. Inasmuch as there is no successful way of overcoming induction or leakage, it would seem that this difficulty is insurmountable. This is not the case, however, and this trouble has been avoided in the following simple manner: All lines over which it is not desired to send time are connected to the confusing hammer, R, so that, in addition to having time signals by induction, they will hear a series of faint, meaningless ticks interpolated between the time signals. This confusing signal, being of the same strength and character as the time signals, cannot be distinguished from it. It may be added that the use of this instrument does not in the least interfere with the clearness and distinctness of conversation over the lines. It is already in successful operation on the Exchange of the New England Telephone Company, Lowell, Mass.

National Underground Electric Company, of New Jersey, displayed an electric conduit for telegraph, telephone and other wires, with testing station for examining, inserting, or removing wires at will.

Perfect Hatcher Company, of Elmira, had a considerable show of chicken hatching and breeding apparatus, the temperature of which was regulated by a sensitive thermostat acting on a double electric circuit, one to check the heat from the heating apparatus, and one to restore it.

Phosphor-Bronze Smelting Company, Limited, of Arch Street, Philadelphia, exhibited a small but varied display of its phosphor-bronze wire, chains, screws, &c.

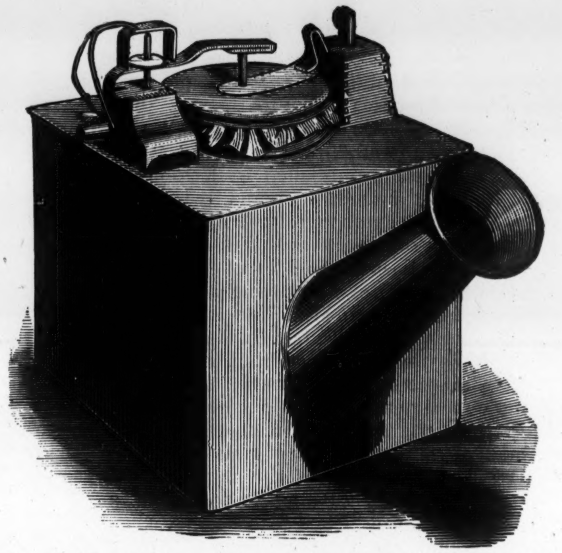


FIG. 10.—*Transmitter. Improvements on the Reis instrument, fig.* 9.

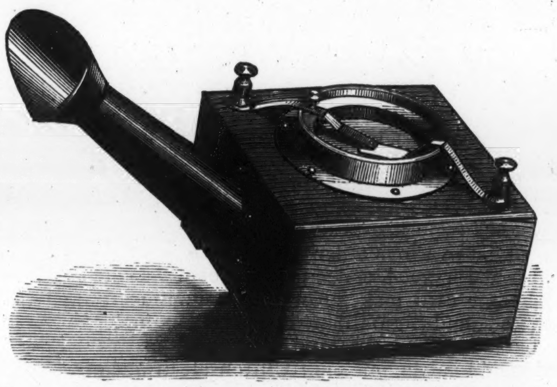


FIG. 9.—*Transmitter constructed from drawing of a Reis instrument.*

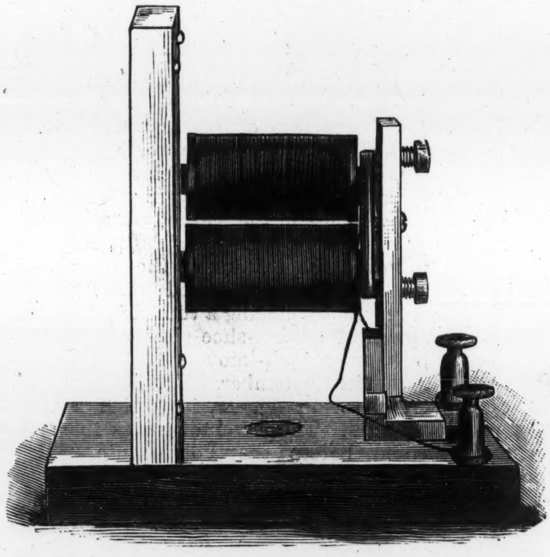


FIG. 12.—*Horse-shoe electro-magnetic receiver with tinned iron diaphragm.*

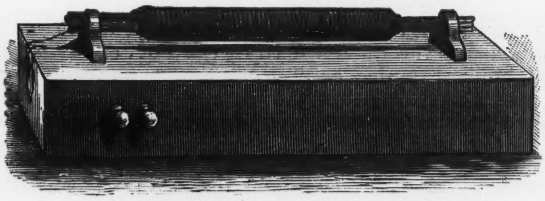


FIG. 10*a*.—*Modification of Reis receiver.*

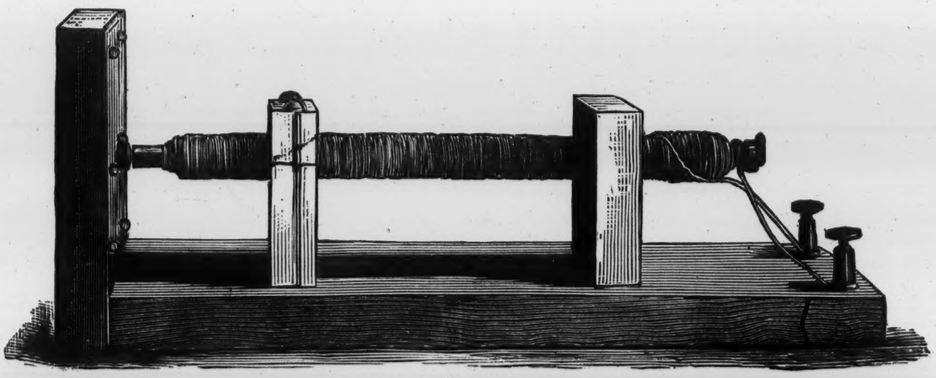


FIG. 11.—*Electro-magnetic receiver, with iron button on a brass diaphragm.*

PROFESSOR VAN DER WEYDE'S TELEPHONIC INSTRUMENTS MADE BETWEEN THE YEARS 1868 AND 1870

Penn Overland Telephone and Telegraph Company, of Philadelphia, one of the anti-Bell companies, had a display of Reis transmitter and receiver of 1861 and

Baxter receiver and transmitter of 1883. But the most interesting part of the exhibit—indeed, one of the most interesting exhibits in the Exhibition, was the set of telephonic instruments invented by Prof. Van der Weyde and exhibited by him at the Cooper Institute, New York, in 1869. His transmitter is very like those of the box form of Reis, only that he substituted an India-rubber membrane for that of parchment and added an adjusting screw to regulate the pressure of the contact point, as seen in fig. 10. We may mention that the instrument shown in fig. 9 was made in 1868, from a description published in Kessler Pesko "Technical Physics," issued in Vienna in 1866. In 1869, the year following, Prof. Van der Weyde's next attempted improvement on the Reis was effected (see fig. 10*a*). It related to the receiver and consisted in substituting a bundle of thin wires of varying lengths instead of the solid bar, his idea being that he would thus avoid the dominant tone of the solid bar. It is evident, indeed Prof. Van der Weyde himself asserts, that he did not believe the transmission of words to be possible, and therefore all his experiments on the subject of telephony were directed to the successful transmission of inarticulate sounds. His next attempt was (to quote his own words) "to make use of the magnetic charge of one end of the bar by causing it to attract a button of iron," which he attached to a spring. Finding, however, that the spring had a pitch of its own depending on the length and thickness of the spring supporting the iron button, his attention was again turned to vibrating plates, on which subject his first public lecture was delivered as far back as 1832.

He soldered an iron button to the centre of a brass plate (see fig. 11), placed in front of an iron bar, surrounded with a coil, and this was the instrument used as a receiver at the lecture of January 8th, 1869. In August, 1870, he read a paper before the American Association for the Advancement of Science which that year assembled at Troy, N.Y., the paper being entitled "Further improvements in the method of transmitting musical melodies by telegraph wire." In the discussion which followed the reading of the paper, one or two of the members present stated that they had obtained good results by placing a tinned iron plate in front of the poles of a horse-shoe electro-magnet, and mentioned this as a well-known device; and on arriving at home in September, 1870, he constructed the apparatus shown in fig. 12, in which a tinned iron plate was used. The inventor states that when he experimented before the Polytechnic Club of the American Institute on January 7th, 1869, several of the persons present stated that they distinctly heard the *words* of the song performed at the other end of the line. Prof. Van der Weyde did not himself credit this, and ascribed their impressions to imagination.

This information is interesting, as bearing on the subject of the Bell 5th claim to the use of the undulatory current, and we therefore have pleasure in bringing it forward. We may add that Prof. Van der Weyde is a native of Holland, is 71 years of age, and is now resident in Brooklyn, N. Y.; he is a good musician, and in 1845 obtained in Amsterdam the gold medal for a text book on physics. In 1849 he went to New York and studied for three years at the University of New York, and obtained in 1857 the degree of Doctor of Medicine; in 1859 he became Professor of Physics at the Cooper Union, and of Chemistry at the New York Medical College. In 1864 he was offered the Professor's Chair of Industrial Sciences at Girard College, Philadelphia, and accepted the same until 1867, when he returned to New York, since which time he has steadily devoted himself to his numerous scientific investigations, the result of only one of which has, we believe, up to the present time been patented. This fact alone seems to bespeak M. Van der Weyde more of the professor than of the professional inventor.

To return to the Penn Company's exhibit, a "Graham" receiver was shown in it; it appears to consist of six small U shaped permanent magnets with their like poles brought into the centre of the telephone; outside this central group there is apparently a piece of steel tube (on which is coiled some insulated wire), to the top of which is fixed a flat brass spring attached by one end to the side of the case, and which presses upwards against a vulcanite or other disc. The pressure of the spring, carrying the steel tube, against the plate being varied by the variation of the current affecting more or less the pull of the permanent magnets.

An "Eaton" receiver is also exhibited, which consists of six small permanent magnets arranged as in the "Graham" instrument above mentioned, with the usual coil of insulated wire around the central group of poles and an inductive plate opposite, but, as in the Bell instruments, not touching. Some Gower-Bell receivers and magneto bells were also shown. The Baxter patents are likewise owned by the Penn Company; see ELECTRICAL REVIEW for May 26th, 1883, for a description of these instruments.

People's Telephone Company.—This company only uncovered its exhibit toward the close of the exhibition on account of the litigation proceeding in New York previously. The illustrated description of the Drawbaugh instrument can, however, be found in the issue of February 16th, 1884, of the ELECTRICAL REVIEW.

Powell Brothers and Company, of Philadelphia, had several specimens of their Hoyt short lap belt. One magnificent belt was shown, 169 feet in length, 40 inches wide, and weighing 1,280 lbs.

Queen and Company, of Philadelphia, exhibited very extensively not only their own special manufactures but also largely those of English and Continental firms, including such eminent manufacturers as Carpentier, Breguet, Elliott Bros., Ayrton and Perry, &c., Ampèremeters, voltmeters and magnetometers by Carpentier were shown; also dead-beat galvanometers by the same firm, and various other well-known instruments. They also had a good collection of Toepler-Holtz machines of their own make, Kohlrausch's ammeters and voltmeters, and Sir William Thomson's ammeters and voltmeters for currents up to 1,000 ampères; Elliott's Gaugain galvanometers; Clifton electrometers, also by Elliott Bros.; Wheatstone bridges and resistance coils by various makers, including Simmons of London and Elliott Bros.

Spellier, Louis H., of Philadelphia, exhibited several of his electric clock devices, attention to which has been directed in the ELECTRICAL REVIEW of June 1st, 1880,

Standard Multiplex Telegraph Company, of New York City, exhibited the Delany inventions. This system of multiplex telegraphy was described in our issue of October 4th last.

Telegraph and Telephonic Protector Company, of New England.—The single protector exhibited by this company has a single coil magnet (the size of an ordinary Morse relay magnet), and its base is about one-fifth the size of the Morse relay. It is, as the name implies, an automatic protector of telephones, telegraphic, and other electrical instruments, intended to arrest and carry to the ground any excess of current over the ordinary or normal, and thus to guarantee entire immunity from the many accidents caused by a

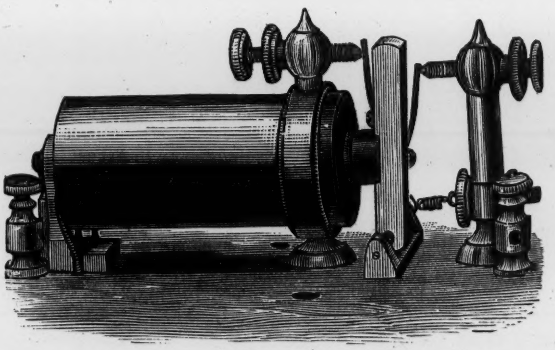


FIG. 13.

sudden increase of current. As long as there is no excess of the current, the instrument remains quiet, and there is no interference with the instruments it is intended to protect; but as soon as the current becomes, from any cause, excessive, it immediately takes up that excess and passes it to the ground, permitting the protected instruments to do their work unmolested. The arrangement will be readily understood by the accompanying drawing. Other modifications of this apparatus were also shown.

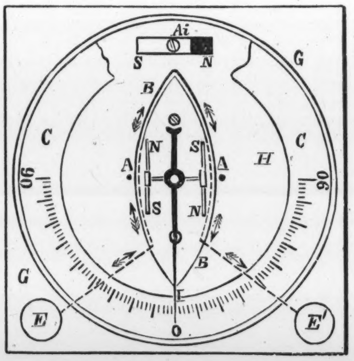
Telemeter Company.—This company displayed telethermometers, telebarometers, telemanometers, and telehydrobarometers. Instruments respectively intended to indicate and register at a distance, differences of temperature, of barometric pressures, of boiler pressure and of the height of water in reservoirs, &c. All the said instruments are provided with maximum and minimum alarms.

Time Telegraph Company, of New York.—This company had on exhibition a master clock controlling or operating about 80 secondary clocks in different parts of the building all electrically connected to the aforesaid master clock. Some of these secondary clocks had their hands moved once a minute, some once in two seconds, and others, again, every second. The master clock is an electric one, being without weights or main-springs, and, consequently, never requires winding.

ASTATIC NEEDLE GALVANOMETER.

Note by M. E. DUCRETET.

THE coil frame in this galvanometer is formed of a single plate, B (either of insulating material or of copper), with an annular neck, upon which is wound the insulated wire in which the current circulates. This wire is connected with the terminals, E, E^1.



The coil frame, B, is fixed flat upon the base, H, of the instrument; immediately above is placed the astatic system, A, A; an index, I, indicates the degree of deflection upon the dial, C. The two needles, N S, S N, of this astatic system are in the same horizontal plane; they move above the coil itself, when it is traversed by a current. This arrangement is essentially different from other known forms. If necessary the directing magnet, A *i*, may be employed.

The sensitiveness of this instrument is further increased by placing above the astatic system, A A, a second flat coil, similar to the first. The wires of the two coils are then joined together. The astatic system moves then between two flat coils. It moves upon a very fine point, being provided with an agate cup, or it may be suspended by a silk fibre. A flat glass covers the whole.

This arrangement has the advantage of being a very simple, sensitive galvanometer, which is easily read, and of a very flat form.—*Comptes Rendus.*

ON THE DISRUPTIVE DISCHARGE OF THE HOLTZ MACHINE.

Note by M. l'ABBE MAZE, in *Comptes Rendus.*

WHEN we employ a Holtz machine in which the exciter is so constructed that the spark may be taken at will on the right or left of the axis of the apparatus, we find that the position given to the movable part of this exciter is far from being unimportant.

Thus, if we leave this complete with its collectors and condenser; if, moreover, we place the two movable arms in such a position that the positive collector is nearer to its condenser than is the other; in short, if we destroy the symmetry by breaking the circuit from the positive side, we obtain, with a moderate distance, two straight feathers of unequal length, the longest corresponding to the positive pole. These feathers do not join, but produce deep detonations. I will call them detonating feathers.

If, without altering the rest of the machine, we change the side of the opening so that the positive conductor will be the longest, the case is completely changed; it will be no longer possible, whatever be the distance between the collectors, to obtain detonating feathers; the ordinary spark is always produced.

Again we may demonstrate the influence of want of symmetry by raising the collector of the positive pole. If then the interception is on the positive side, we can obtain a very broad and very long double feather. If, on the contrary, the interruption is on the side of the negative pole, the feather attains at most one half the length. If we raise the collector of the negative pole, the influence of symmetry is not manifested.

We may repeat these experiments after having raised the condensers; the phenomena are generally the same as in the previous case, but much less intense.

Moreover, the importance of the question of symmetry is not only proved by optical phenomena. Mechanical effects lead to the same conclusions. In fact, if, after having deprived the exciter of its collectors, we suspend between the points a strip of paper 0·10 m. long and 0·2 m. wide, making the opening on the positive pole side, the paper is energetically repelled by the negative pole; if, on the contrary, the interruption is on the side with the negative pole, the repulsion is caused by the positive pole. This experiment succeeds with or without condensers, but the result is much clearer when they are not used.

It is worthy of remark that, if the branches of the exciter are placed symmetrically in relation to the axis of the machine, repulsion is produced with the positive pole with Leyden jars; by the negative pole when these are not employed.

In writing the preceding, I have confined myself to the simple statement of facts, without attempting to prejudice any theory. It seems to me that the cause of the phenomena observed should be regarded as a reciprocal induction of the various parts of the machine.

JONES'S STATIC COMPENSATOR FOR DUPLEX AND QUADRUPLEX TELEGRAPHY.

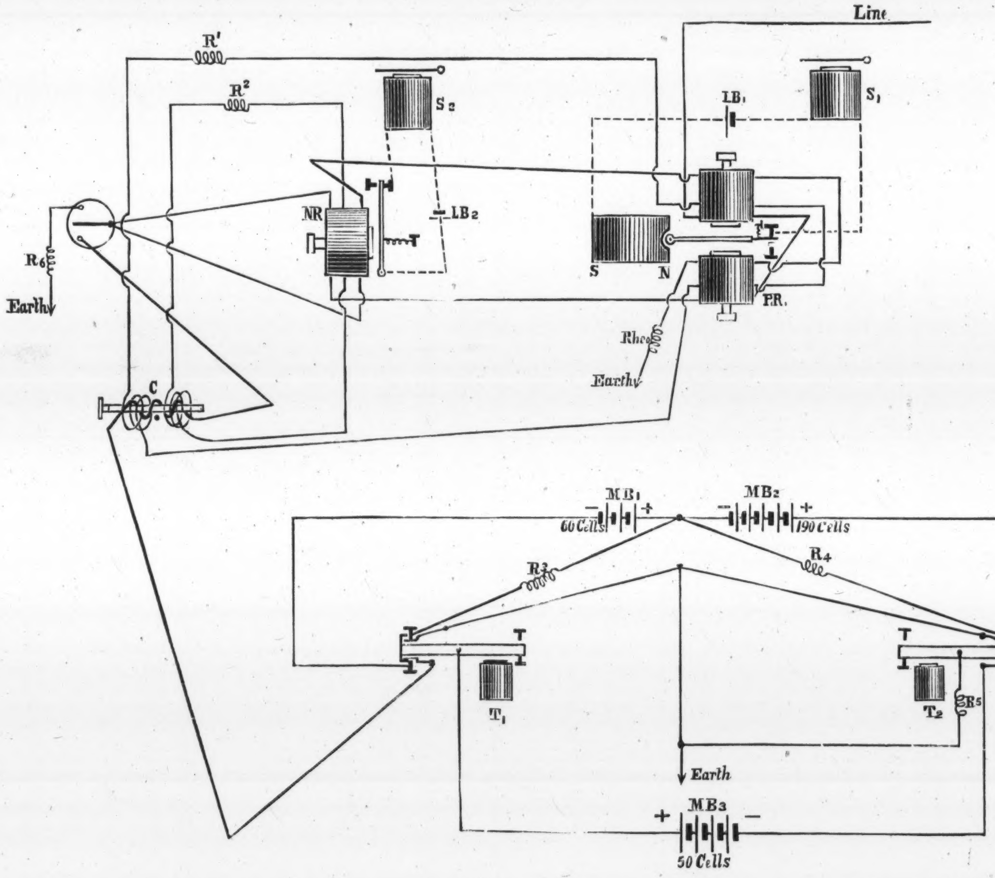
TO enable duplex working on long land lines to be successfully accomplished, it was soon found that some method of compensating for the static charge of the line was necessary. This was first effected by Mr. J. B. Stearns, by his well-known condenser method, and his invention is now practically universally adopted. Mr. G. K. Winter, in India, a short time afterwards, devised an electro-magnetic arrangement by which compensation was obtained by the "extra current" from an electro-magnet. Still more recently, Mr. F. W. Jones, Electrician of the Bankers and Merchants Telegraph Company, New York, has invented a new system of compensation by means of inductoriums, which gives very satisfactory results. Mr. Jones has also applied his method to a new quadruplex system which he has devised, and which is worked with perfect success on a line 260 miles long, between New York and Boston. The method of compensation in the new system is the most important feature, being extremely simple, cheap, and effective.

Mr. Jones's apparatus is shown by the figure, and is as follows :—N R is a short-core neutral relay ; P R, a polarised relay, with a light spring on one side of its tongue ; T_1 and T_9 are double transmitters, arranged to be worked in local circuits with keys and local electro-magnets ; M B_1, M B_2, and M B_3, are sections of the main battery ; R_1, R_2, R_3, R_4, R_5, and R_6, are adjustable resistance coils ; Rheo. is the usual rheostat in the artificial circuit for balancing the line ; C is an inductorium, the primary coil of which is included in the main circuit between the transmitters and the dividing point where the wires pass differentially around the relays to line and artificial circuit. Two secondary wires are connected to neutralising coils on the relays, these coils being wound or connected in such a way that the magnetising effect of the secondary current, which flows in them when the signalling current flows in the primary, will neutralise the momentary tendency of the current flowing in the main-line coils on the relays to produce a false signal, owing to the greater static capacity of the line, and similarly the reverse current set up in the secondary by the opening of the transmitting key or keys will neutralise the disturbing tendencies of the static-discharge current from the line, flowing in a reverse direction in the main-line coils.

The combinations of the current which can be transmitted to line by the action of the transmitters, T_1 and T_2, are as follows :—

T_1 and T_2 closed :	a positive current of strength	50
T_1 closed and T_2 open :	„ „ „	240
T_1 open and T_2 closed :	negative „ „	60
T_1 and T_2 open ;	„ „ „	300

When T_1 and T_2 are closed, the distant relays corresponding to N R and P R are actuated as follows :—N R is opened and closes its sounder, S_2, on the back stop ; P R is closed and closes its sounder, S_1. When T_2 opens, then the current is increased and closes N R, opening S_2. When T_2 is closed and T_1 opens, then the current is changed from 50 positive to 60 negative, which opens P R and S_1, but does not affect N R and S_2, as it is adjusted above the strength of either 50 or 60 cells. When both transmitters open, the current becomes 300, which closes N R, opening S_2, and opening P R, and consequently opening S_1. The resistances, R_1 and R_2, are for regulating the secondary discharge. The other resistances are to preserve equality of resistance in the various paths opened up to the incoming currents, so as not to disturb the distant balance.



THE NATIONAL CONFERENCE OF ELECTRICIANS, PHILADELPHIA.

(*Reported specially for the "Electrical Review."*)

(*Continued from page* 332.)

WEDNESDAY, SEPTEMBER 10TH, 1884.

The PRESIDENT : The announcement of the committee is now in order. The committee having the subject of Electric Light and the consideration of Mr. Preece's motion with respect to the watt, two matters in charge, has been selected by the commission as follows :—Prof. John Trowbridge, Chairman ; Mr. W. H. Preece, E. C. Pickering, Prof. Charles R. Cross, Prof. George F. Barker, Thomas A. Edison, Major D. P. Heap, of the Army.

The committee to consider Prof. Abbe's subject is as follows :—Prof. Abbe, Chairman ; Lieut. James Allen, Prof. John Trowbridge, W. W. Jacques, F. N. Gisborne, Mr. W. H. Preece, F. E. Nipher.

It is purposed to add one or two more to this committee to represent the telegraph companies of this country. Being unfamiliar with the proper persons, these names have been left to be added.

These committees will make a preliminary report, I think, to-morrow morning, so that these subjects can be brought up for discussion by the Conference. I myself am more in favour of having these questions discussed here than in having them brought before these committees.

Prof. N. B. **SNYDER** here read his paper on "The Establishment of a National Bureau of Physical Standards," which we may perhaps publish at a future date, and a discussion ensued, in which Prof. Rogers, Sir William Thomson and others took part.

Lieut. **ALLEN** also read a paper in which he reviewed the work done by the Signal Service towards securing standards of thermometry and barometry.

THURSDAY, SEPTEMBER 11TH, 1884.

The Conference met pursuant to adjournment.

Prof. **TROWBRIDGE**: Before proceeding to pass upon the minutes for Tuesday, I should like to recommend a change in the language of the motions. I move that the motions be so amended that the words "legal adoption by the United States" be substituted for the words "recognition" in the existing motions. One of the motions, for example, would then read:—"That the Commission be authorised to take the proper steps to secure the legal adoption by the United States of the ohm defined by the Paris Conference as the legal unit of electrical resistance in this country," and similarly for the other motions.

The **PRESIDENT**: Prof. Trowbridge has a motion before the house, and the question is simply, shall the words "legal adoption by the United Sates" be substituted for "recognition" in these motions?

The motion being submitted to the Conference for adoption was carried.

The **PRESIDENT**: Reports of committees are now in order. I will call upon the committee which was appointed to consider the subject of the watt, if it has any report to make. Prof. John Trowbridge is chairman of that committee.

Prof. **TROWBRIDGE**: It is a surprise to me that I am on a committee on the subject of the watt, and therefore I shall call upon Mr. Preece to give us his views upon this subject, as I understand that he has prepared a short and informal statement in regard to the adoption of the watt.

Mr. **PREECE**: Mr. President,—I regret that other duties at Montreal and the heat of the weather have prevented my writing down properly what I should have liked to have said respecting the adoption of the watt as a unit of power. Now that it has been virtually decided that all electrical measurements shall be given in the terms of the C.G.S. system, it seems essential that all our units—units of work and units of power should also be connected with this system, so that we shall avoid the use of any coefficients whatever.

Of all the units that have been introduced, there really is not a single one more important than that which records the rate of doing work—work of electrical currents or the work of moving a tramcar, or any mechanical work. These are all precisely of the same kind. It is quite possible to express the work done in an oil lamp, a gas lamp, or an arc lamp, in exactly the same terms, and by way of parenthesis I might just mention that a more careful calculation of the work done in different systems of artificial illumination shows that while the simple sperm candle that is taken as the British standard of light consumes 97 watts for each candle, the gas lamp, such as we use in London, burning five cubic feet per hour, giving, I think, 14 candles, consumes 62 watts per candle. So that we have there a ratio of the rate of doing work between two systems of illumination, one by the sperm candle which consumes 97 watts, and the other by the gas lamp, which consumes 62 watts. But when we come to electric lighting, we find that a good incandescent light gives out its illumination at the rate of 2·5 watts per candle. So you see how easy it is to express in terms of this watt the ratio of the energy expended in different modes of artificial illumination, and to see how we can economise, and what a question of vast importance the subject of electric lighting is.

What is a watt? A watt is the rate at which work is done when an ampère is maintained in an ohm. When you maintain through an ohm an ampère current, we are doing work at the rate of 1 watt per second. This unit was proposed by Sir William Siemens two years ago, and it became such a necessity that it was instantly adopted by all practical electricians in England. It has been used to a very large extent by practical electricians here. This unit was previously expressed as the volt-ampère, but being a subject of such vast importance it only wants the authority of this commission to add it to the list of units already accepted. It has been accepted by the British Association at Montreal, where I brought before them the same proposition, and with the assistance of the British Association and this commission I have not the slightest doubt that the term "watt" will be introduced all over the world. I tried to bring this before the Paris Conference last year, and the reason why it was not accepted was twofold—first, the Germans objected to the introduction of any more English names; and, secondly, the French objected to it because they have no w in the French language. These two objections do not apply to us. Watt was an American as much as an Englishman, and we should be proud to apply his name to the unit which is connected with his measure.

We want a large unit for power; the Watt is small. The Watt is excessively valuable for electrical measurement; it is too small for mechanical measurement. If we were to adopt the decimal system of measurement we might call a thousand watts a kilowatt; but there is no reason why horse-power should not be retained, and my proposition is (it is a proposition which is received with a great deal of favour by some of our mechanical engineers on the other side), that the horse-power itself should be altered. It is now 746 watts; but if we increase that by 34 per cent., that is, if we raise that horse-power from 33,000 foot pounds per minute to 44,220 foot pounds per minute, we shall obtain a horse-power which shall be exactly a thousand watts, and shall have a unit that shall connect all physical measurements with mechanical measurements, with no co-efficient introduced, and we shall have more sensible units than we have had.

So, Sir, the proposition that I had intended to write down for your acceptance was that the unit of power shall in future be the Watt, and that the horse power shall be raised 34 per cent., in order that it may be a thousand times this unit of power which we call a Watt.

Prof. **NEWCOMB**: I would like to ask a question with regard to the Watt as defined by the electricians, in whose company I am not to be counted. It is defined purely electrical. I would like to ask if that corresponds to the C. G. S. system; how many ergs per second is it?

Prof. **BRICE**: It is ten to the seventh power per second. The real unit of work in the C. G. S. system is an erg per second, but that is too small, and it has been raised to the seventh power which gives the Watt.

Prof. **NEWCOMB**: I would rather see the mechanical than the electrical definition adopted although they amount to the same thing, and it would be better to take the sixth power of ten rather than the seventh power in our whole system of units. I make that suggestion to the members of the committee.

Mr. **CROSS**: It seems to me that we might follow out Mr. Preece's suggestion and call a thousand watts a kilo-watt, or we might multiply the watt by a thousand, and call it horse-power i there were no confusion with the French "force de cheval" and the English horse-power as so used.

The **PRESIDENT**: It has been suggested to me that no report has been called from the committee on the standards of light. The committee on the Watt and the standards of light are the same.

Prof. **TROWBRIDGE**: It is eminently proper that the two committees should be one, and that the Watt should be referred to the committee on the standard of light. I yield the floor to Mr. Preece, as I think he has some very interesting remarks to make on that subject. I am unable to get a meeting of the committee on the standard of light, because several of the members have gone home. But I believe it is before you now, in the resolution that you have adopted that this committee continue its labours and submit a report whenever the Chair may decide that a discussion on the subject may be opened, and report in print, the day and period to be assigned within not less than three months. Of course further experiments must be made, and the committee must have communications from whoever is interested in the subject. Whoever of the conferees is interested in the subject will communicate with the committee either by word, or in writing within three months, and their communication will receive the proper attention. The difficulties of the subject are very great, and as I have said I shall yield the floor to Mr. Preece, and I hope he will give us some of his views upon the subject. It seems to me the unit adopted by the French Conference is eminently an impracticable one, and Mr. Preece has actually seen the experiments in Paris upon these, I might almost call theoretical standards of light, and I think he agrees with me that America should not adopt that standard of light, at least hurriedly and before other experiments are made.

Mr. **PREECE**: This question of a proper standard of light is one that has occupied our attention in England now for some two or three years, and there exists a committee on standards of light which has existed now for two years, but which has not done much work. The question is still in doubt, and is one that requires very careful consideration, and not very hurried consideration. Prof. Geo. Forbes, who is here, is a member of that committee, and during the next four months we shall undertake to make considerable experiments in England, and I trust that this meeting will form a permanent committee on this subject, so that simultaneously with our work in England, experiments may be carrie on on this side of the water.

There are two points involved in this subject. The first, a practical one; the establishment of some standard of light that we can all understand, that we can all work by and reproduce in our own laboratories at any time: and there is another and more difficult one of a standard of white light—the two things are quite different. You want a practical standard of light to enable you to carry out your measurements in terms of something you know is absolute. You want also to have a definition of white light so as to be able to express the efficiency and the value of different characters of light in terms of something that shall collect all the lights together by some such system as we have been discussing.

We propose during the next twelve months to put aside this question of white light and examine all the practical standards that can be found in the market that are in use.

We also are going to test the value of the human eye to measure and compare these different lights. There is unquestionably a personal equation connected with this measurement of light. It has never been thoroughly gone into on our side of the water, and I do not think it has been on this. One of our first acts when we go back to London will be to organise a system of measuring the efficiency of the human eye for the determination of the value of light. At the present moment there are three or four real standards.

In England we have the British standard—the candle as it has been defined by Act of Parliament. It is a particular kind of sperm candle that burns 120 grains every hour, and it has to possess a certain height of flame. Then we have in Germany another candle, different in value from this English candle. In France we have the Carcel lamp, burning a certain quantity of oil at a certain rate per hour, and giving a flame of a certain height. The value of the French standard is actually 9·7 that of the British candle.

Then we have another standard that has not been accepted at present by anybody but myself. It has been accepted by myself, because I produced it. This is another standard altogether. It is not a standard of light, it is a standard of illumination. I want to know the illumination of this surface of white paper. [Indicating.] I lay it on the table here, or I lay it on the floor or anywhere, and I want to know what the illumination of its surface is, taking sunlight or moonlight, taking gas light or candle light or the electric light. What I want to do, is to establish some standard that will enable us to measure the illumination of a surface. For instance, I take a street that is lighted by gas, and the street that is lighted by incandescent lamps, and I want to know the illumination of the surface of the street in different places. You want to know the illumination of your shop-front, or the sides of your house. You want to have some mode of expressing this in order to understand the intensity of light quite independently of the source of the light. The standard I have proposed is the light upon such a surface as that white paper when the light is emitted from a British candle at 12·7 inches. I have made it 12·7 inches because that corresponds with the light emitted by a French carcel lamp at a distance of a metre.

There are a few questions we shall discuss through this committee in England. The first is the most practicable standard of light; 2nd, the practical standard of illumination, and 3rd, the most practical mode of measuring photometrically these two. The British standard candle is an admirable theoretical standard for expressing the numerical value of light, but we find the incandescent lamp is by far the most convenient instrument to compare lights by.

It is not a very difficult thing to determine the light emitted by an incandescent lamp with a given current, and you can produce that light when you know your current, at any time within months and months after the experiment.

If you have an incandescent lamp which you only use for measuring light, you can maintain that lamp constant for any number of months. Captain Abney and myself have worked very hard on this question, and we find an incandescent lamp is a very handy and convenient instrument for measuring other lights, and you can express this light in terms of the British candle, so as to bring in the unit.

I shall not be able to take part in the considerations of this matter. I do not think we should be hasty. I think it will take months to enquire into this matter. However, before I leave for England, which will be in the middle of October, I will put in writing all my views and submit them to the committee for their consideration.

I might add just one word more. Another object that we have in view is, that by using an incandescent lamp whose light depends simply upon the work expended in the given filament, and whose light therefore can be expressed in terms of the Watt, we have by taking an equal filament as our measure, expressed this light in terms of the candle, so that we have a direct connection between the measurements of light and the measurement of the candle-power, and through the Watt we come at once to the measurement of light in the C. G. S. system of absolute units.

Mr. Koyle: There have been some experiments made upon the subject, and it has been decided by those who know most, that among standards of light depending upon the light produced, the current of electricity through a metal of high resistance, is the best we know. Would it not be better to use instead of an incandescent lamp, which is now composed of a long filament of carbon some three inches in length, something like platinum, having a square surface. The light emitted by surface of platinum of half a centimetre or a centimetre of definite resistance under a given current, would be constant. We would then measure at right angles to the illuminated surface and have a much more constant standard of light than with the carbon filament, which we measure at right angles to the curve of the carbon filament.

Prof. Cross: I would like to say that there appears no necessity to use carbon light as a primary standard. As a primary standard you can have the carbon filament made of a length which is definite; but as a secondary standard I can see that it would be one of the best standards that we can have. I do not understand whether Mr. Preece intends to use the incandescent light as a primary or as a secondary standard.

Mr. Preece: At present we only contemplate using the incandescent light as a secondary source or standard. With regard to the use of a platinum point—that was proposed by Henry Draper. It was found that platinum was most unreliable under those circumstances. There was a constant disintegration at the surface and the light varied a great deal. I do not think any experiments with the platinum wire are valuable.

Prof. Cross: It seems to me that we ought not attempt to go too far, that is, to connect the sensation of light, which is of course all we mean when we say "light," with the C.G.S. system. All we know is, that in a lamp so arranged we have a definite amount of energy that affects the eye. Light proper is a sensation, and of course we cannot hope to connect that with the C.G.S. system.

The President: The Chair does not understand that there is any motion before the house on this subject, and I will now proceed with the discussion of "The Theory of the Dynamo Electric Machine." I have prepared here a skeleton of the theory of the dynamo machines. I don't claim for it perfection. I only claim to give a few points in the theory of the dynamo machine which may be of interest and possibly of value to those who are constructing these machines. Mr. Fitzgerald was to second me in this discussion, and give some important points on the subject, and the discussion will be more or less imperfect unless he arrives.

The principal losses of the machine are put down under these heads:—1. Mechanical friction; 2. Foucault currents in the armature; 3. Energy arrested in magnetising the magnets; 4. Self induction of the currents.

These are the number of losses which I at least intend to discuss. Of course the efficiency of the machine would then be equal to the whole work of the machine minus the different losses divided by w, namely

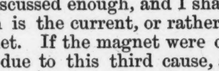
$$E = \frac{w - l_1 - l_2}{w}$$

Thus, when these losses are obtained, the efficiency of the machine is known. The mechanical friction I shall not discuss. With respect to the loss from Foucault currents in the armature, by dividing up the armature in the proper way, we can get rid of most of these currents. It is a method very often affected in the Siemens armature by dividing up the armature into discs. The greater portion of the currents are got rid of in that way.

I have purposely omitted the loss due to the change of magnetism of the armature. As the armature revolves in one of these machines the iron changes in magnetism. It has been recently experimented upon, and been found that although there is some small heating effect, yet it is very small indeed. I drew attention to this fact several years ago, and experiments have been made upon this very subject by makers of the dynamo machines, and Edison, for instance, has evolved a dynamo made up in this manner, so that the Foucault currents do not exist; so that practically this loss amounts to nothing. I think that that question has been discussed enough, and I shall therefore take up the third loss, which is the current, or rather the energy used in sustaining the magnet. If the magnet were of steel there would of course be no loss due to this third cause, and the only reason for not using a steel magnet is that they cannot get sufficient field; the field is moderately weak. I cannot give you the ratio, but I suppose it is at least one-third of that due to an electro-magnet. Perhaps this point may be brought up in the discussion, and somebody can give us the results. But so far as I know now the field from a permanent magnet is generally less than one-third of that from a good electro-magnet. It could not be made equal to it by any possible means. Therefore in most dynamo machines that are used on a large scale the magnet is produced by the current. It is a question what the form of a magnet and the position of the coils should be in order to get the greatest field with the least expenditure of energy.

The first proposition I have to make is, that a round magnet is better than one of an elongated cross section. Those who have used the old Siemens machine will recollect that the magnets there were formed of a system of bars around which the wire was placed. If the coils are long (I do not know that it is necessary to assume that they are long, if they are long enough for the purpose, and the coils are generally long enough—the theory assumes an infinite length of wire)—the magnetic force at any time acting on a round iron core is exactly the same as on an elongated core; but the area of a circular section is much greater than that of an elongated section for the same circumference, and therefore the same amount of wire which would be used to go around the elongated magnet could be extended further on a circular section, and we would obtain very much more work. Some people say that the principal object of making an elongated magnet is that it may include the whole length of the armature. Suppose we were constructing a dynamo machine with a very elongated magnet; we would have to elongate it here (see fig. 1), and make a pole piece in which the armature might revolve. Most makers who adopt this form think that it is better to elongate this (*a*, fig. 2) out in the direction of the arrows. But we have seen that the round form is more efficient in general than the elongated form, and the only question is whether it will be more efficient in this particular case. I shall proceed on this theory upon the known fact that you can consider lines of force as if they were conducted by the iron and the air outside. The conductivity of the iron for the lines of force is very great—much greater than

FIG. 1.



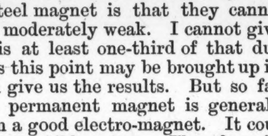


FIG. 2.

that of air. I experimented on it many years ago, and my idea is that the greatest value of the conductivity was something like 5,000 times that of air. It depends upon the magnetic force, and of course it is a variable quantity. I think it varies from several hundred up to 5,000 times that of air. The conductivity is very great, especially for wrought iron; for cast iron it is probably less. Therefore the lines of force will be conducted down from any point over a circular cross section very nearly as easily as they are over an elongated cross section, and the saving in the wire will be considerable.

I have another proposition to make with respect to the magnet, and that is that one circuit of the lines of force is better than a number. Some makers might connect the pole-pieces of the armature to a number of electro-magnets, and even if they were round there is loss from having a number. For this reason, that the same amount of wire produces the same magnetic force in each of these coil pieces, provided there is the same number of wires per unit of length, and that same amount of wire might be made to go nine times around the iron instead of three times. Therefore you would get inside of your magnet three times as much iron as you would do, and yet have the same magnetising force acting on the magnet. The proposition is that one circuit is better than two, and that not only applies to this form of armature (fig. 3), but it also applies to the form where we have the armature revolving between two magnets like this (fig. 4). The circuit of the lines of force are around in this direction, and in this (see arrows fig. 4). So that there are two circuits of the lines of force instead of one. The working energy expended with a given amount of work will be less with the form shown in fig. 3 than in the form where you have two circuits like that above alluded to; that is of very great value to makers of machines. I had a number of drawings made simply of magnets in the Electrical Exhibition, and I find very great difference in this respect. There is more difference in this respect where Siemens armatures are used than in any other kind of armatures. In discussing these drawings I do not give any names, nor say whether any one machine is better or worse than another; but I merely discuss the aspects of the case, and illustrate by some machines which are found in the Electrical Exhibition.

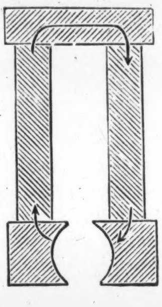


FIG. 3.

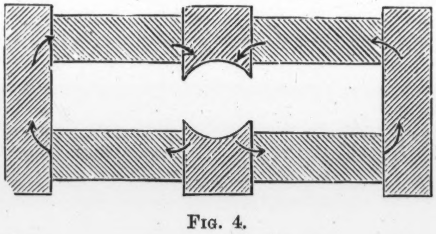


FIG. 4.

First I will discuss in general the forms of the magnet, and I wish to say something in respect to the form of the poles that enclose the armature. Of course these forms belong both to the Gramme ring and the Siemens armature, and you may consider them both one if you wish. This form (fig. 2) belongs to both of these and almost any form. We will now proceed with respect to the field in fig. 5.

The lines of force proceed down the magnet, and are supposed to go across here, *a* to *b*. Wires are wound around this armature, and revolve around across the lines of force, and so produce a current. It is evident that any lines which escape across this part (see arrows) are lost. If there was any leakage of the wire around the magnet that would be lost. In case the wires touch there would not be much loss, but if there was a leakage in the wire, the current, instead of going around the magnet, would go off somewhere else, and we should consider the machine defective, because there was a loss of the current. If these lines of force, instead of going across from *a* to *b*, go across here (arrows), as they naturally would do, all those lines of force are lost, and we would have to add so much more current in order to make up for this outsde loss. I have an illustration of this from the drawing which I will give you in fig. 6.

This machine has two magnets, one above and one below. The lines of force pass up there, *a*, and then out through here, *b*, and then up through there, *c*. Those outside pieces, *d*, instead of being far off are down close. Here is one pole of the magnet near this piece. The lines of force, instead of going down here (indicating) and passing across the field of force as they ought to do, pass off here (arrows); the circuit cannot go around, for it would go down and across this opening and up that way (arrows). In this case there is loss due to the lines of force leaking out; and if these pieces are too near, the lines of force will pass across that opening instead of passing across the opening where the wires revolve, so that there will be a loss, and we shall have to enlarge our magnet, and therefore have more energy expended in keeping up the magnet. There is energy expended in keeping up the field outside as well as in keeping up the field of the magnet. So with respect to this machine it is important that this point should be considered. In this form of the machine (fig. 3), where there is a small circuit, this magnet has to be attached somewhere. They usually put on a piece of brass across the poles to attach it to. Very often this magnet is turned vertically in this way, and then the whole thing is attached to a cast iron plate. I have no doubt that considerable lines of force are lost in passing across this magnet to this iron piece. I do not think much is lost at that point, but some is lost. The makers of the machine, I suppose, considered this to some extent, but what is needed is measurement on that point. How many lines of force go across the armature opening and are effective in producing the current, and how many escape and are lost? These questions are just as important as the question of the leakage of the current in the wire.

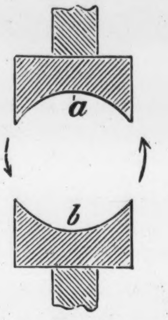


FIG. 5.

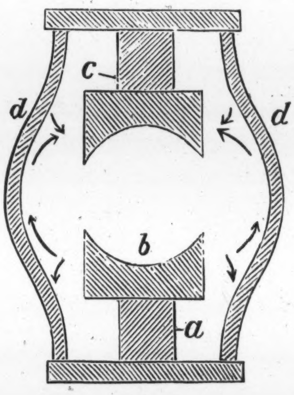


FIG. 6.

There are defects in many of these machines in that respect. By the way, in this last form some people may say the putting this here and here (indicating *d*, *d*), adds to the strength of the magnet. It does undoubtedly add to the strength of the magnet, but those are useless lines of force that pass across here (arrows). If you measure it here the strength is increased, but you do not increase the result when you take into consideration the loss.

(To be continued.)

REVIEWS.

Traité Pratique d'Electricité Industrielle. (*Practical Treatise of Industrial Electricity*). Par E. CADIAT and L. DUBOST.

The authors of this compilation make the rather strange admission that the multiplicity of works on electricity is their greatest defect. They set out, therefore, in the object of condensing into brief compass what is already known, so that engineers, &c., in search of some particular piece of information may be able to find it.

The work is not written for savants, nor, on the other hand, for the general public. The reader is supposed to be acquainted with the ordinary sources of electricity. There is no denying that for works of this class there is still an opening.

The authors set out with general principles, definitions, the chemical action of currents, their thermic and magnetic action, the laws of induction, &c. They then pass to units and to electric measurements, galvanometers, measurements of intensity, of quantity, of resistances, of capacity and of energy, and lastly of light.

The second part of the work treats of apparatus for the production of electricity, arranged under the heads of batteries, machines, and accumulators.

Electric lighting takes up a prominent position. Here the authors point out a difference between lighting with gas and with electricity which is not always kept in mind. With electricity the first cost is the main point, the actual working expenses being comparatively trifling. With gas the case is exactly reversed. Hence with electricity it is advantageous to multiply as far as possible the hours of work and the number of lamps. A small gas installation working for a few hours daily is economical, whilst under similar conditions the electric light is ruinous.

The electric transmission of energy is considered at great length. The authors quote the well-known tables and conclusions of Beringer.

The fifth part, which deals with electro-metallurgy, is the least satisfactory portion of the work, especially that section which relates to the application of electrolysis to the quantitative determination of certain metals. That in certain cases the analysis of minerals can thus be effected with greater accuracy and convenience than by any other method is undeniable. But there are others in which electrolytic procedures show no advantage over the ordinary methods, and under all circumstances a variety of precautions have to be carefully observed, *e.g.*, as regards the exact strength of the current.

Hence our authors, unless prepared to devote a much larger space to this subject, would have done well to have simply referred the reader to those modern works on analytical chemistry in which the electrolytic procedures are fully discussed.

It seems strange that, whilst telephony is made the subject of a distinct chapter, the telegraph is completely overlooked.

The illustrations are numerous and very good, and the book altogether has been got up in a most satisfactory manner.

La Polarisation des Recepteurs Teléphoniques. (*Polarisation of Telephonic Receivers.*) By J. W. GILTAY.

In this memoir, which is a reprint from the *Archives Néerlandaises*, the author enters upon the minute study of the telephonic action of the condenser, and undertakes to give an explanation of the singular action of the auxiliary battery. He considers that he has shown why polarisation is necessary as well in condensers as in telephones.

The Electric Lighting Act.—A deputation from the Lambeth Vestry, on Monday, waited upon Mr. Calcraft, the Assistant-Secretary to the Board of Trade, and urged that under the license granted to the vestry for lighting Lambeth by electricity, power might be given to sub-let to a company; and that the vestry should be considered the local authority instead of the Metropolitan Board of Works. The deputation also objected to the clauses for the protection of the Postmaster-General. Mr. Calcraft, replying, promised to communicate with the vestry upon the subject of sub-letting, and said the Board of Trade was willing that the vestry should be the local authority; but could not leave out the clauses rendering necessary the consent of the Postmaster-General.

M. JABLOCHKOFF'S NEW BATTERY.

FOR a considerable time M. Jablochkoff has been engaged in studying a new battery. Although it is not yet possible to form a definite judgment as to its value, it is interesting to know its principle.

An element of this battery is formed as follows:—M. Jablochkoff takes a small rod of sodium, weighing about 8 grms. This rod is flattened so as to form a plate about 0·15 metre long, 0·02 wide, and 0·006 metre thick. At one end there is made a slit, into which is introduced a small tongue of amalgamated copper upon which the sodium is tightened, so as to form a good contact; this little plate serves to receive the current. On the other hand there is a small plate of carbon, about 0·20 metre in length and 0·02 in breadth. This carbon is not such as is used for arc lights nor for batteries. It is an agglomerate like them, but it ought to be very porous and light. This plate of carbon is perforated with three small holes, into which are put small wooden pegs. The sodium plate is then wrapped in a band of silk paper; it is laid upon the carbon plate and pressed in such a manner that the wooden pegs may penetrate into the soft metal and fix it upon the carbon. For greater security the whole is tied together by means of a few turns of fine iron wire, taking care that it does not form an electric contact between the sodium and the carbon. The element is thus complete, the carbon and the small leaf of copper fixed in the sodium form the electrodes.

This battery acts, says a writer in *La Lumière Electrique*, in virtue of the affinity of the sodium for oxygen. This metal, on exposure to air, becomes oxidised, forming caustic soda, which condenses the moisture of the air, dissolves and drains gradually away in a concentrated solution, thus exposing the surface of the metal, which then continues the reaction.

The electric conditions of this couple have been measured at Breguet's establishment. Its electromotive force is = 2·5 volts, its current = 0·1 ampère, which gives an internal resistance of 25 ohms. The weight of the element is in all about 50 grammes, and its price is lower than it might seem at first sight. M. Jablochkoff thinks that on the large scale sodium might be obtained at a very low figure. At present it may be had at 10 francs per kilo.

A small element thus constructed is not to be considered as the unit of the battery. M. Jablochkoff proposes to group 10 of them in quantity; for this purpose the rods of carbon are traversed by two holes in their entire length. Through these holes is passed an iron wire, terminating in a ring. By means of these rings the small elements are suspended upon rods of wood supporting a copper packing, which forms the necessary communication for associating them by tens in quantity. The group thus formed gives an ampère on short circuit.

These groups are then associated either in series or quantity, like the elements of ordinary batteries. It is convenient to keep them suspended so that the solution of caustic soda which is formed may readily flow off.

Such a battery acts as long as the air is moist. The only means to stop its action is to shut it up in an air-tight case.

According to M. Jablochkoff the battery, when arranged, can act for 24 hours in a sufficiently regular manner if it is placed in an atmosphere which does not vary. The electromotive force depends on the degree of moisture on the temperature and on the ambient air. The inventor considers that this circumstance gives an advantageous means for regulating the action of the battery.

Proposed Electric Tramcars for Blackpool.—The Blackpool Town Council has resolved to recommend electricity as the motive power for the new tramways to be laid along the promenade in that town. It is expected that the service will commence early next season.

OBITUARY.

ROBERT HENRY SABINE.

It is with profound sorrow that we have to record the death of this eminent English electrician. Some six months since Mr. Sabine was attacked by a malady from which a complete recovery is rarely expected; yet owing to the skill of his medical advisers he had so far become convalescent that his friends were fain to believe that, by giving up all professional pursuits and mental exercise, he would with careful attention enjoy comparatively good health for some years to come.

However, these hopes were suddenly dispelled when, on the afternoon of Friday, the 24th ult., he was again seized with a return of his complaint, although in a different form. After lingering in an unconscious state till about 3 o'clock on Saturday morning, he breathed his last, at the early age of 47 years, and was interred at Kensal Green Cemetery on the following Wednesday.

Robert Henry Sabine was born at Dorchester (Dorset), November 6th, 1837, and was the eldest son of the late Henry Sydenham Sabine, solicitor, then of that place, and subsequently of Bristol.

He was educated at private schools in the neighbourhood of Bristol, and always evinced a strong partiality for the study of mathematics and scientific subjects, passing the whole of his leisure time in reading works on engineering, electricity, astronomy, &c., and in making rough attempts at constructing various apparatus, models of engines, &c.

When about 17 he was placed in his father's office with the object of studying for the legal profession; but after remaining there for a year or two he showed so great a dislike for these studies, that it was decided he should go to Manchester with a view to entering one of the engineering firms at that place. Here he was introduced to the late Sir William (then Mr.) Siemens, who had recently established a business as an electrical and telegraph engineer in London. The acquaintance quickly resulted in Mr. Sabine being engaged by Mr. Siemens as his assistant electrician, and in this capacity he had ample facilities for prosecuting his studies in electricity and engineering. In the following year (1859) he was sent on board H.M.S. *Firebrand* to carry out a series of experiments in the Mediterranean with a deep-sea thermometer, invented by Mr. Siemens; and on his return from this work he was transferred to the establishment of Siemens and Halske, of Berlin, with a view of completing his practical knowledge. He was afterwards engaged in carrying out tests for Messrs. Siemens, on behalf of the British Government, of the Malta-Alexandria cable, and was on board the *Queen Victoria* when that vessel ran aground under Mount Edgcombe at Plymouth. Afterwards he was engaged, with Mr. C. W. Siemens, on board the *Dix Decembre*, in laying the Oran-Carthagena cable.

In 1867 he left the firm of Siemens, Halske & Co., and commenced business on his own account as an electrical and consulting engineer, and he acted for some years with Mr. Latimer Clark, in supervising the Pneumatic Despatch Company's engineering operations.

About the years 1871–2 he undertook the direction of a small private factory of the late Sir Charles Wheatstone, and when this, two years later, developed into the British Telegraph Manufactory, Mr. Sabine was for some time managing director of that company. It was here that, after a huge experimental machine had been constructed by Messrs. Cooke and Whieldon, of Westminster, the first Gramme machines were manufactured, and many valuable experiments in dynamo-electric machine construction, electric lighting, and transmission of power were carried out under his supervision.

He was afterwards for some years in partnership with Sir Samuel Canning, but within about 18 months previous to his death he had again practised on his own account.

His literary labours are well known and highly prized by the whole electrical community throughout the world, his principal productions being the "History and Progress of the Electric Telegraph" and the "Electrical Tables and Formulæ," which he brought out jointly with Mr. Latimer Clark. He also wrote many valuable papers, amongst which we may mention "A Method of Measuring the Contour of Electric Waves passing through Telegraph Lines," "On a Method of Measuring Very Small Intervals of Time," and "The Pneumatic Transmission of Telegrams," the latter in conjunction with Mr. R. S. Culley.

He was a valued contributor to the columns of the ELECTRICAL REVIEW, and was one of the first to point out in our columns the importance of taking into consideration the loss of energy in electric light conductors.

Mr. Sabine's knowledge of submarine cable operations was most profound, and the same may be said of his insight into all other branches of electrical and civil engineering in which he was engaged.

Our acquaintance with him commenced in 1869, and for about 10 years we assisted him in all his varied labours, and since that time it has been our good fortune to be more or less associated with much of his later work. We owe to Mr. Sabine's memory a deep debt of gratitude for many a graceful act of friendship accorded to us during the past, and it is with the most sincere regret that we mourn the loss of him who, all too soon, has been taken from our midst.

Married to Sir Charles Wheatstone's second daughter, by whom he had one son, now about nine years of age, he led an eminently simple life; by nature of a retiring disposition he avoided all public notice; he was conscientious to a degree, and kept himself strictly aloof from partiality to any one thing, in order that his professional opinion on any subject brought before him might be perfectly unbiassed.

Latterly he has not appeared much before the world in any capacity, but he has left unpublished records of much good and valuable work in the domain of electrical science.

In concluding this too brief notice of a life so full of good, we can but add to the expressions of our sorrow one other, and that is, that a man of more thorough straightforwardness can not be found; his place can not be filled.

NOTES.

Electric Lighting. — Ottawa, Ontario, is to be the first town in the Dominion of Canada to be entirely lighted with electricity; the gas and naptha lamps now in use upon the streets are to be discarded as soon as the contract with the Royal Electric Company of Montreal, awarded by the City Council, can be carried into effect. Power for running the dynamo machines will be taken from the inexhaustible supply of Chaudiere Falls, and the system employed will be that of the American Electric and Illuminating Company, to whose Canadian business the Royal Company is successor.

For nearly three months past the London and North Western Railway Company has been running an express train between Liverpool and Manchester, which is completely lighted by electricity. A Brotherhood engine, stationed upon the tender of the locomotive and fed with steam from the boilers, drives a Siemens regulating dynamo, which supplies the current for 19 Swan incandescent lamps of 20 C.P. each. The driver has on the locomotive a switch upon which is fitted a pilot lamp, the latter indicating the manner in which the lamps in the train are burning; and there is also one of Ayrton and Perry's spring ammeters in connection with the switch, showing the current strength. In each compartment are two lamps enclosed in an ordinary carriage lamp; only one of these is in use, however, the second being switched on should the other at any time go out. The lighting is under the direction of Mr. J. W. Fletcher, the chief telegraph superintendent of the company, and has been in continual use, night and day, since August 6th. The train journeys between Liverpool and Manchester only, three times each way per day. The experiment has attracted considerable attention and has been watched with much interest in the north, and it is possible that it may lead to the introduction of the electric light in other trains and on other systems. Manchester is singularly well situated for this class of lighting, as so many through trains proceed thence, being neither added to nor broken up during their journeys. Traffic of this kind, of course, offers much greater facilities for electric lighting than trains which are continually subject to additions and disconnections.

The use of the electric light in theatres is becoming more and more general in America. The first experiments in New York were made in the Madison Square and Third Avenue Theatres by means of storage batteries; but these were by no means successful, and have now been discontinued. Those managers who adopted the system of direct lighting have been more fortunate; and it is estimated that within a year one electric lighting company has put sixteen thousand incandescent lamps in places of amusement in the United States outside of New York. At the Eden Museé, New York, 340 lamps are in use 12 hours per day, every day in the week; the light from these, the manager estimates, is equivalent to that given from a daily consumption of 22,300 cubic feet of gas, which would cost over $50 a day, whereas the cost of the electric light is only $14.25. At Koster and Bial's Concert Hall 240 electric lights have recently taken the place of gas. The cost is about one-third less than gas; but, the manager says, there would be economy in using it even if it came much higher. The managers who have tried the light unanimously decide in its favour, one remarking: "I put in the electric light this season, and I wonder now how I could ever have got along without it. There is nothing in the way of scenic effect of which gas is capable that cannot be done more easily and satisfactorily by electricity. Yes; the theatre is better lighted and at less expense." Mr. Kiralfy, of the Star Theatre, said: "I have 200 electric lights now on the stage in the transformation scene. There is no limit to the startling and dazzling effects that may be produced by such means. If every theatre that we went to had it I would not be obliged to carry my electric light machine about the country with me. But it is only a question of time when they must all use it. It is the first step that costs. After that there is no question but that it is cheaper than gas in every way."

As a sequel to the gas question which has for some time been engaging the attention of the inhabitants of Linlithgow, a proposal has been made to have the town electrically lighted, and negotiations are going on with the electric lighting companies with the view of ascertaining the initial and annual costs.

At Brighton the electric light is in use at the Grand Hotel, the Castle Hotel, the Orleans Club, and Chapel Royal, besides the Aquarium, the Brighton Terminus, and in the shops of many leading firms. In Hastings some half dozen hotels, including the Grand and the New Club, have taken the light; and in Eastbourne the Grand Hotel and others are similarly lighted. At each of the above places the plant at first put down has been found insufficient to cope with the increasing demand for the light, and accordingly important extensions are either going forward or are about to be commenced at once. The light is supplied from a central station, having an area in each case of some six to eight miles, so that any one making an application for lights can be supplied in one or two days. The whole of the above is being carried out by the Hammond Electric Light Company, who have been doing the work at Brighton for three years past, and who are now working the other two places by arrangement with the respective local companies. The consumer pays on the same basis as for gas, that is for the light actually used and registered by meter, the charge being a halfpenny per light per hour

Chambers's Journal for this month contains a well-written article on "The Future of Electricity and Gas," in which the question is asked: "Is the electric light a failure, and are all the hopes that have been placed in it to end in nothing?" The answer given is, "Assuredly not. The explanation of the present lull in electric lighting is not far to seek; it is due almost solely and entirely to speculation. The reins, so to say, had been taken from the hands of engineers and men of science; the stock-jobbers had mounted the chariot, and the mad gallop that followed has ended in ruin and collapse. . . . . . That the electric light has not proved a failure may be gleaned from a rough survey of what has been done during the past two years, in spite of unmerited depression and depreciation." Then follows a brief summary of the principal installations in this country, in America, and on the Continent; after which the advantages of the electric light for use in dwelling houses, theatres, museums, libraries, churches, shops, factories and ships, are descanted upon. The writer, does not, however, anticipate that gas will be altogether superseded, but thinks that in the future it will be largely used as a fuel and a power producer.

Mr. Eltringham, boiler maker, of South Shields, has just lighted his works by means of 12 Brush arc lamps, driving the dynamo from the engine used in the works. The installation has been carried out by the Hammond Electric Light and Power Supply Company, Limited, and great satisfaction is expressed at the result.

The Postal Telephonic Exchange at Plymouth.—The joint committee of the Chamber and Mercantile Association appointed to consider the present position of the Telephone Exchange in the neighbourhood of Plymouth has arrived at a conclusion which will be embodied in memorials to the Postmaster-General. Separate memorials will be forwarded from the Chamber, and from the Plymouth and Devonport Mercantile Associations; these will all be similar in effect. That from the Plymouth Chamber calls attention to the fact that at the present moment the department has an exchange at Plymouth which has been in use for over two years, and to which there are only some 42 subscribers. Nearly all those subscribers are members of the Chamber, and while they have no reason to complain either of the instruments or the manner in which the duties of the department working the exchange are carried out, yet they report that the exchange is of little or no benefit to them because the number of subscribers is so few. The conclusions arrived at by the joint committee are, that the annual subscription is far too high to induce further subscribers to join, and that it should be considerably reduced; that Devonport and Stonehouse should be considered with Plymouth as one town, the postal exchanges being joined by trunk lines, the radius of distance of each subscriber to be calculated from the General Post Offices of Plymouth and Devonport, and from the trunk connection at Stonehouse; that subscribers in Plymouth, Stonehouse, or Devonport should be able to communicate with the subscribers in either town, and that a representative from the Postal Telephone Department be sent down to confer with the inhabitants, collect information, and report how best this may be done. The memorialists believe that if these suggestions are adopted and carried out the exchange for the three towns will become a most valuable institution, will secure the accession of a large number of the inhabitants, and bring in a substantial income to the Postal Department.

The Aberdeen Telephone Service.—The latest issue of the National Telephone Company's list of subscribers for Aberdeen and district shows an increase of 70 connections since the commencement of the present year.

Telephone Infringements.—The Chairman of the United Telephone Company has issued an advertisement stating that the directors have ascertained that a prospectus is being privately circulated soliciting subscriptions to a company intended to be formed for the purpose of supplying a telephone called the "Valve" telephone; and that they feel it their duty to warn the public that the "Valve" telephone is, as they are advised, an infringement of the patent rights held by the United Telephone Company. Should any attempt be made to manufacture or supply the "Valve" telephone, the company's solicitors have been instructed to take proceedings to protect the company's patent rights. A similar warning is also given with respect to the "Boult" telephone. Suitable replies have been made by the representatives of both the "Boult" and "Valve" telephones, so that we may shortly expect some further telephonic litigation.

Action Against a Telephone Company.—In the City of London Court last week, Mr. O. B. C. Harrison sitting for the Commissioner, an action was tried in which Mr. Tyler, a financial agent in Cannon Street, sought to recover against the United Telephone Company damages in respect of the non-performance of a contract. The plaintiff had telephonic communication through the defendant company with his bankers, Messrs. Barker, of Mincing Lane. At the time when he alleged his cause of action arose, those gentlemen removed their premises some few doors further off, and consequently the communication was severed. The plaintiff then called upon the company to perform their contract to deliver his messages; but, as they failed to comply within what he considered a reasonable time, he made other arrangements with the Post Office authorities. His legal advisers forwarded to the company a claim for specific performance, and also claimed damages for loss of time and inconvenience occasioned, as he had in course of his business to communicate with his bankers repeatedly during the day. During the hearing a technical question arose as to the jurisdiction of the court in such a matter; the claim for specific performance having been abandoned. The judge ruled that he could not enter upon the question of damages, as the suit was originally one in equity, whereas the point now before the court was one to be decided at common law. A nonsuit was therefore entered; it was stated that the case would be taken on appeal to the High Court.

Cable Repairs.—The repairs of the West India and Panama Telegraph Company's original cable between Jamaica and Porto Rico were completed on the 24th ult. By the re-establishment of this cable the duplicated telegraphic system of the West Indies is now in working order from Jamaica to Trinidad.

The Commercial Cables.—It is understood that the wires of the Commercial Cable Company will be ready for the use of the public about November 15th. It is stated that the company does not intent to cut rates for the present.

Submarine Cables in War Time.—Replying to a correspondent of the *Pall Mall Gazette*, Sir James Anderson says:—"I have not a word to say against cables being laid anywhere if Governments care to subsidise them, but it is altogether misleading to assume that cables laid where proposed, or the fortification of the landing-places, will give us any security whatever for uninterrupted telegraphic communication. There should be as many alternative lines of communication as possible, so as to make it not worth while for any enemy to cut cables. . . . Cables laid in short sections, despatch vessels specially fitted, and ships with cable, to connect such points as may be desirable in the vicinity where war is imminent or in progress, is the only method of providing for telegraph communication in time of war, where there exist no alternate lines in the hands of neutral Powers."

The Tasmanian Cable.—The cable between Victoria and Tasmania, which was broken on July 29th, is still unrepaired, owing to an unusual continuance of stormy weather in the Straits.

The Soudan Telegraphs.—Telegraph stations are being erected along the Nile between Wady Halfa, and Merawi.

The Telegraph in Central Asia.—The new telegraph line through Katy-Kurgan to the capital of Bokhara is now stated to be open for international correspondence. The line is altogether 180 versts long, 30 versts only being on Russian territory. Russian telegraphists have been sent to do the work in Bokhara, at the expense of the Bokharan Government. The Ameer will also pay for keeping the line in order for 12 years.

Telegraphic Charges in Australia.—The Superintendent of Telegraphs of South Australia states that "in future cipher rate is only to be charged in the case of artificially constructed words or groups of figures, a group of five letters or figures counting as one word, but one such group making the whole message chargeable with cipher rate. Proper names or plain dictionary words, whether they have a connective meaning or not, are to be accepted at ordinary rates."

Sixpenny Telegrams.—In the House of Commons, last week, Mr. Ruston asked the Postmaster-General whether he could inform the House when he would introduce the sixpenny telegrams. Mr. Fawcett said there was no intention to alter the decision which the Chancellor of the Exchequer announced when introducing his Budget, that the reduced rate for inland telegrams would be brought into operation on the 1st of August next.

Telegraph Revenue.—The receipts on the telegraph service, from April 1st to October 25th, 1884, amounted to £1,080,000; from April 1st to October 27th, 1883, they were £1,075,000.

Telegrams from Ben Nevis.—From the Observatory on Ben Nevis 1,046 telegrams have been despatched by tourists during the past summer.

Accident at the Health Exhibition.—With reference to the recent accident with the Hochhausen machine at the Healtheries, Mr. W. B. Esson has called our attention to the fact that under some circumstances of faulty insulation in the dynamo machine the shock experienced by touching one of the brushes and the framework would be much more severe than that experienced by touching both brushes. Mr. Esson supposes the case of a contact between one of the coils of the armature and the frame, and remarks that in such a case a person placing one hand on a brush and the other on the frame, would experience the shock due to a current created by an E.M.F. which alternates in each revolution of the armature between 0 and the full E.M.F. of the machine. When the faulty coil is touching the brush upon which one hand rests there is obviously no difference of potential between the frame and that brush, since the coil is in contact with the frame. But when that particular coil is diametrically opposite the brush, there is between the brush and the frame a difference of potential equal to the full E.M.F. of the dynamo. The unfortunate individual who may have one hand on a brush and the other on the frame thus experiences a shock due to what is to all intents and purposes an alternating current; and this fact, which has an important bearing on the question of danger from high E.M.F. machines, has been hitherto overlooked. Where the fault in the armature is of high resistance, the shock experienced is merely a question of degree; but the main thing to be pointed out is that such a shock is quite different in character from that experienced by placing both hands on the brushes, in which case the shock is from an E.M.F. which does not vary.

Greenock Time Signal.—The fifth annual report of Mr. John Love, treasurer, states that on five days in the winter months there was no time owing to breakdowns caused by storms. On 18th March the "preliminary current" (which always appears in the instrument-room of the local post office a few seconds before the signal hour), being unsteady, it was cut off. The signal, which is supported by voluntary subscriptions, a rent of £12 per annum being paid to the Post Office, remains the sole authoritative standard of time in Greenock. Mr. Love continues:—*Apropos* of the Postmaster-General's promise to introduce "sixpenny telegrams" in August next, it is surely permissible to hope that some reduction will by-and-by be made in the tariff for time-currents. The minimum rental for the 10 o'clock current is £12 a-year, which is equal to ninepence halfpenny a day. Considering not merely the great public interests which are involved in the supply of true time, but also the fact that the same current goes to all the renters in the three kingdoms, we have a right to expect that the charge should be put at the lowest possible point. I fear, however, that no concession will be made until either the Chambers of Commerce move in the question, or some member of Parliament arises who will undertake to worry the Government of the day into granting it.

Travelling in the Air.—A paper by M. W. de Fonvielle, Vice-President of the Balloon Society of Paris, was read at a meeting of the Balloon Society in the Royal Aquarium, on Friday night, on "Travelling in the Air. Present and Future." The paper of M. de Fonveille was read by Mr. C. E. Parker-Rhodes. The writer summarised the results of M. Tissandier's experiments in the application of electricity to the steering of balloons, and then directed attention to the recent ascents of MM. Renard and Krebs, and more especially to that made during a calm, when they were enabled to return to the point from which they started. This, as there was no means of steering against the wind when there was no wind at all, was valuable as a school-boy demonstration for unbelievers. Under such favourable atmospheric conditions, moreover, the results could be calculated with precision. Some surprise had been expressed that his gallant countrymen, the Meudon captains, should have observed any secrecy in publishing those results, but that must really be attributed to the reticent propensities of the War Office. The voltaic apparatus employed by M. Renard he did not consider the best possible. It was merely an adaptation of a primary battery used in theatres for providing dancers with electric lights. It was necessary to correct a false impression with regard to the power of going against the wind, unless, indeed, when the velocity of the wind was less than that which could be imparted to the balloon by artificial means. Such motive power was always very small in comparison with atmospheric disturbances. Believing that this difficulty must remain, even if they used steam, which might be rendered at least ten times more serviceable than electricity for a given weight, he pointed out that travelling in the air with a directed balloon was not an affair of brute force but rather of intelligence. Aeronautical electrical apparatus with screw propeller, worked by a secondary battery, incandescent lights for reading meteorological instruments, &c., for the aeronaut, were exhibited by Messrs. Woodhouse and Rawson. A discussion followed, and on the motion of Mr. Merritt, seconded by the Earl of Belfast, it was resolved unanimously, "That in the opinion of this meeting joint action should be taken by France and this nation to promote scientific research in the direction of aeronautical navigation by electricity during the year 1885."

The Coming Telegraph Conference.—The Liverpool Chamber of Commerce on Wednesday instructed the secretary to write to the Board of Trade asking that department to see that British interests were protected at the coming International Telegraph Congress at Berlin.

Institution of Civil Engineers.—The council of the Institution invite original communications on various subjects, for which, if approved, premiums will be awarded. In a list of 43 subjects are included the following:—The thermic properties of metals commonly used in the arts, especially with respect to conductivity and diathermancy at high pressures; Mechanical power on tramways, including steam, compressed air, electricity, cables, &c.; Underground haulage, especially on the application of compressed air, and of electrical power; Electro-motors: their theory, practical construction, efficiency, and power; On gearing for dynamo machines, motors, and other high-speed machines; The transmission and distribution of electricity over large areas for lighting and for motive power, including electric railways, hoists, &c.; Electrical measuring instruments; Submarine telegraph cables, their manufacture, laying, and repair, including deep-sea sounding; Telpherage, or the automatic electrical transport of goods and passengers; The measurement of work by dynamometers, with descriptions of the apparatus. The following awards were made for papers contributed during session 1883-84:—A Telford medal and a Telford premium to Thomas Andrews, Assoc. M. Inst. C.E., F.R.S.E., for his paper, printed in the proceedings, but not discussed, on "Galvanic action between wrought-iron, cast metals, and various steels during long exposure in sea water;" the Miller scholarship to Alfred Richard Sennett, Stud. Inst. C.E., for his paper on "The Electric Light."

Electrical Torpedoes.—It has been brought to our notice that a portion of our comment on the system of torpedo warfare devised by Mr. Williams, was hardly warranted. The floating batteries are not necessarily connected permanently by submarine cables for the purpose of charging the accumulators which they contain, as this may be done from launches carrying the necessary apparatus. It is possible that we may again return to this subject when a fitting opportunity presents itself.

The Sunday Post.—Mr. Bright says, with respect to Sunday Postal deliveries, "The Post Office is our great means not only of commercial, but of family communication. . . . It is a great public service, an honourable labour, and it must be compensated for as other services are." A correspondent thinks this doctrine is not quite in accord with Mr. Fawcett's, who recently declined to accede to the request of the provincial telegraphists for payment for Sunday labour.

The British Association.—The Manchester City Council has unanimously decided to invite the British Association to hold its 1886 meeting in that city, or, failing that, in the following year.

The United Telephone Company.—In the House of Commons, on Thursday, Mr. Kenny asked the Postmaster-General if it was a fact that a proposition had been made to Government to buy up the interests of the United Telephone Company and its affiliated companies, at the sum of £2,000,000. Mr. Fawcett said no such suggestion had been made.

Underground Wires.—The Western Union Telegraph Company has given a contract to lay its wires underground in Philadelphia to Mr. David Brooks.

An Electric Fish.—It is stated that an electric ray (*Torpedo vulgaris*), was caught last week at Porthleven, Cornwall. It weighed 55 lb., was 3½ ft. long, and had a caudal fin 10 in. across. Shocks quite as strong as desired were obtained, and an electric bell was sounded, but not for long. According to the account given, the torpedo had two fish in its mouth, a bass 2 ft. long, and a conger 2½ ft. long, a fact—if it is a fact—which serves to support the view that the electric ray uses its powers to paralyse its prey.

NEW COMPANY REGISTERED.

Iron Primary Battery Company, Limited.—Capital £20,000, in £5 shares. Objects: To supply electric light and power by means of Noad's and Matthews's patent, or other process. Signatories (with one share each), *Rowland Matthews, 21, City Road; *James Noad, East Ham; *S. Trickett, Millwall; *H. C. Bunkell and H. B. Bunkell, 13, Queen Street, E.C.; R. Woolley, 2, Russell Road, Leyton; W. Lowen, 51, Buckland Street, Hoxton. The first four signatories are directors. Qualification for future directors: 50 shares. Remuneration: £1 1s. to each director for every attendance. Registered 29th ult., by H. E. Kisbey, 106, Cheapside.

* Signatories whose names are preceded by an asterisk are also directors.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

United Telephone Company of the River Plate, Limited.—The annual return of this company, made up to the 21st ult., was filed on the 25th ult. The nominal capital is £200,000, in 40,000 shares of £5 each; 20,266 shares have been taken up and the full amount has been called thereon, the calls paid amounting to £101,280, leaving £50 unpaid. As compared with the statutory return, the paid-up capital shows an increase of £155. Registered office, 131, Wool Exchange, Coleman Street.

British Electric Light Company, Limited.—The annual return of this company, made up to the 16th ult., was filed on the 24th ult. The nominal capital is £100,000, divided into 10,000 shares of £10 each; 7,291 shares have been taken up and the full amount has been paid thereon. As compared with the previous return, the paid-up capital shows an increase of £500, 50 shares having been subscribed for during the year. Registered office, Turk's Head Yard, Turnmill Street, Clerkenwell.

An agreement, dated 18th September, between the British Electric Light Company, Limited, of the first part, Edward Easton, C.E., of 11, Delahay Street, Westminster, of the second part, and William F. Williams, of the Villa, Muswell Hill, of the third part, was filed with the registered documents of this company on the 3rd ult. This agreement relates to the surrender of the lease of the company's premises, an injunction having been granted by the High Court of Chancery to restrain the company from continuing an alleged nuisance by the emission of smoke and other effluvia from the working of a steam engine. Mr. Williams therefore agrees to accept the surrender in consideration of the company paying his costs and the rent of the premises up to the date of such surrender, and also in consideration of the payment of £20, and an allotment of 50 fully-paid preference shares of £10 each. It is also agreed that Mr. E. Easton will accept from Mr. Williams a lease of the Burlington Buildings (second block), Heddon Street, St. James', at the yearly rent of £1,150, and will expend a sum of not less than £2,500 in converting the same into residential chambers.

CITY NOTES.

Great Western Electric Light and Power Company, Limited.

"A SHAREHOLDER" in this company, writing to the *Financial News*, says:—The low estimation in which the shares of the company are held at present is, perhaps, unique in the history of the Stock Exchange. The company's capital consists of 24,744 shares of £2 10s. each, fully paid up, and they are selling on the Stock Exchange at 10s. per share; so that the whole of the company's assets can be bought up for £12,372, or, rather, that is what they are valued at on the Stock Exchange.

According to the company's balance sheet of June 30 last, which was certified as correct by the eminent firm of auditors, Messrs. Turquand, Youngs & Co., its assets consisted of the following items, namely:—

Freehold and leasehold land and buildings at Bristol and Cardiff	£4,312
Plant and machinery in use and on hire, less depreciation	6,046
Stock of machinery and stores valued at current rates	2,359
Office furniture, less depreciation	144
Cash at bankers	16,640
Sundry debtors	2,715
Total assets	£32,216

The only liability which the company has is for £1,800 for supplies, so that if the company had to be wound up to-day it would be able to divide about £30,416 amongst its shareholders, or equal to 25s. per share; and yet the shares are actually selling at 10s. each on the Stock Exchange!

The cash alone which the company has in the bank is equal to nearly 14s. per share. Anything more absurd I never met with.

This company possesses the exclusive right to use the Brush patents in the western counties of England and the southern counties of Wales, and if the Brush Company has any future at all before it, then this company's shares present a magnificent opportunity for investment by those who hold electric light company's shares at five or ten times the present prices, and, in any case, if the company should be wound up, the shares are clearly worth 20s. to 24s. each.

Spanish National Submarine Telegraph Company, Limited.—A drawing of the 6 per cent. mortgage debentures, to be paid off on December 31st, will take place in the presence of a Notary Public at the offices of the company, 106, Cannon Street, E.C., November 10th, at 12 noon.

Electric News Telegraph Company, Limited.—The creditors of this company are requested to send particulars of their claims, on or before November 12th, to Messrs. Harries Wilkinson and Raikes, 24, Coleman Street, London, E.C.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending October 24th, were £2,724; after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

NEW PATENTS—1884.

13810. "Armatures for dynamo-electric machines." F. WYNNE, R. P. SELLON. Dated October 18.

13816. "Telephonic apparatus." S. WILLIAMS. Dated October 18.

13861. "Electro-motors." S. H. EMMENS, UNITED PATENTS CORPORATION. Dated October 20.

13862. "Utilising exhaust fluids from galvanic batteries." S. H. EMMENS, UNITED PATENTS CORPORATION. Dated October 20.

13863. "Electrical storage batteries." S. H. EMMENS, UNITED PATENTS CORPORATION. Dated October 20.

13879. "Construction and working of electric accumulators and apparatus or means therefor." J. S. WILLIAMS. Dated October 20.

13880. "Portable electric apparatus." J. S. WILLIAMS. Dated October 20.

13882. "Method of regulating and varying electric force in electric circuits and apparatus or devices therefor, their construction and application." J. S. WILLIAMS. Dated October 20.

13883. "Incandescent electric apparatus or means used in the manufacture thereof." J. S. WILLIAMS. Dated October 20.

13913. "Electric arc lamps." T. J. HANDFORD. (Communicated by R. H. Mather.) Dated October 21. (*Complete.*)

13922. "Electric generator." J. IMRAY. (Communicated by P. Jablochkoff.) Dated October 21.

13931. "Transforming electric currents and the means therefor." J. C. MEWBURN. (Communicated by M. Deprez.) Dated October 21.

13941. "Electric motors." W. R. LAKE. (Communicated by J. B. Atwater.) Dated October 21. (*Complete.*)

13986. "Galvanic batteries." J. E. CHASTER. Dated October 22.

14008. "Electric guns and cartridges." S. RUSSELL. Dated October 22. (*Complete.*)

14009. "Electroliers." A. EVANS. Dated October 22.

14013. "Primary and secondary batteries." E. G. DORNBUSCH. Dated October 22.

14016. "Electric arc lamps." J. H. JOHNSON. (Communicated by Buss, Sombart & Co.) Dated October 22.

14045. "Incandescent electric lamps." R. C. JACKSON, J. B. DUNCAN. Dated October 23.

14046. "Incandescent electric lamp holders." R. C. JACKSON, J. B. DUNCAN. Dated October 23.

14067. "Igniting gas by electricity as applied to driving of engines." E. WILSON. Dated October 24.

14068. "Electric telephonic apparatus." H. T. O. FRASER. Dated October 24.

14073. "Instrument for measuring currents of electricity." J. A. KINGDON, A. BOWER. Dated October 24.

14109. "Instrument for use in the high tension system of electric lighting." A. WRIGHT. Dated October 25.

14122. "Measurement and estimation of amount of light emitted from a luminous body." J. JOLY. Dated October 25.

14143. "Regulating supply of liquids to galvanic batteries." J. ENRIGHT. Dated May 6.

14197. "Preparation or manufacture of elements for primary electric batteries." C. P. ELIESON. Dated October 27.

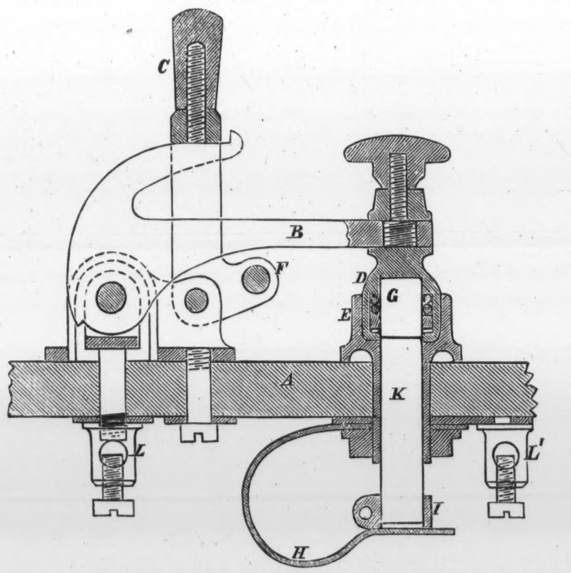
14200. "Accumulators of electricity." J. MYERS. Dated October 27.

14202. "Electric signalling apparatus." J. L. CRAWFORD. Dated October 27.

14233. "Construction and application of induction coils." J. and E. HOPKINSON. Dated October 28.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

8448. "Electric switch." E. F. H. H. LANCKERT. Dated May 30. 6d. The fig. is a section of one form of electric switch embodying the invention. On a base, A, of insulating material is mounted a lever, B, which by means of a hand lever, C, acting on the curved arm of B, can be depressed to the position shown, in which position the bulb, D, attached to the lever, B, is pressed into the cup, E, making intimate contact, so that there is complete conduction from L to L^1. On pulling back the hand lever, C, a pin, F, on its arm raises the lever, B, breaking the contact of D and E. In order to avoid the sparking and its consequences, the inventor fixes in the bulb, D, a stick, G, of carbon, securing it therein by a screw nozzle pressing on a packing of copper wire rope, and in the socket, I, of a spring, H, which is attached by a nut to the tubular stem of the cup, E, he fixes another carbon stick, K, which passes through the stem of E, and is pressed by the spring against G. After contact with D and E is broken, the carbon K follows the carbon G, maintaining contact with it until the socket, I, comes to bear against the stem of E, when they separate, and the circuit is completely broken. And similarly in the act of closing the circuit, the two carbons, G and K, first come into contact before D reaches F.



11501. "Improvements in electric arc lamps." C. LEVER. Dated May 30. 4d. This invention relates to improvements in the electric arc light apparatus described in the specification of a former patent granted to the inventor on the 3rd May, 1882, No. 2092, and is intended to accomplish the following object, viz., to enable the electric arc lamps constructed according to the said previous invention, to be more effectively worked in series from a shunt or compound wound dynamo machine or from a separately excited dynamo machine.

CORRESPONDENCE.

Domestic Electric Lighting.

I have read with interest the communication of Mr. W. H. Preece on "Domestic Electric Lighting," in your issue of the 25th inst., "British Association for Advancement of Science," Montreal, 1884.

Would he, or any of your readers, give me his personal experience and results in using secondary batteries for the purpose of lighting as regards duration, attendance and particular cares required in good and continual running order? Would he also state the kind of secondary battery he would most recommend. I think a little more information on the subject would be of general interest.

Alfred Foillot.

Partner of the firm des Fils de Peugeot Frères.

Valentigney (Doubs),
October 27th, 1884.

Duplex and Quadruplex Telegraphy.

I should be glad if you could inform me to whom the P. O. pay royalties on the duplex and quadruplex instruments, and why? The system used for duplexing short lines appears to be absolutely identical with that invented by Frischen and Siemens-Halske in 1854.* For longer lines a condenser is used. Does that form the subject of letters patent? With respect to the quadruplex. As the pole-changer of Gerritt-Smith has been abandoned, and the compound relay is being superseded, I suppose that the quadruplex is now public property, or does the condenser come in there?

It is probable this might interest others besides

Electricista.

P.S.—Perhaps Mr. Handford, or other of your correspondents, would kindly say whether the manufacture for sale of sets of duplex telegraphs, on either Bridge or differential systems, for *educational purposes* or otherwise, would constitute an infringement of any patent controlling duplex telegraphy?

[The post office pay Mr. Stearns certain royalties for the use of condensers both for duplex and quadruplex apparatus. No royalty is paid in cases where no condensers are used. As regards the quadruplex instruments, the royalties are, we believe, paid for the use of the *general* system as invented by Edison, including the compound relay of Gerritt-Smith. Whether the disuse of the pole-changer and the compound relay will cause any modification to be made in the royalties to be paid we are unable to say.—EDS. ELEC. REV.]

The Mechanic Receiver.

It is not easy to understand Mr. Barney's position in this matter. On page 297 (October 11th) he contradicts a statement without supplying the data. The "mechanic" receiver was so called because it was first described (in England) in the *English Mechanic* of August 11th, 1876: there would be no meaning in the specific term "mechanic" otherwise. Mr. Barney, however, says that the "first definite intimation in England" was "published many months before that date," but does not say where and when. I think he has mistaken the force of the word "definite."

Prof. Bell's lecture before the Massachusetts Institute of Technology was delivered on May 25th, 1876 (that was the first *public* intimation anywhere); Dr. W. H. Stone performed, I believe, the identical experiments at South Kensington on July 24th, 1876, and on August 11th, 1876, a description sufficiently explicit to enable any intelligent human being to make a telephone appeared in the *English Mechanic*.

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* Sabine's "Electric Telegraph," part 1, page 158, 1867 edition.

Mr. Barney says (page 342, October 25th) that the "*first* notice" of Bell's original invention "was on September 15th, 1876, in *Engineering*. Permit me to point out that at that time "all the world" knew of Bell's invention, because it had been described a week previously by Sir W. Thomson in his address as President of Section A, British Association, which address was duly reported in the daily papers.

Mr. Barney's "many months" appears to depend on the fact that Bell's paper was presented to the American Academy of Arts and Sciences on May 10th, 1876, but I submit that was scarcely "the first definite intimation in England," and Mr. Barney fails to state when the volume referred to was received at the Public Library of the Patent Office. The "first definite intimation" must be held to be the first publication in a journal exposed for public sale, and that was in the *English Mechanic* of August 11th, 1876.

"S. R."

With reference to the letter from "*Stat nominio umbra*," in last week's issue, we shall be glad if you will allow us to contradict the statement that we were "indemnified by the London and Globe Telephone Company," in the actions taken against us by the United Telephone Company. Such was never the case.

We acted in *agreement* with the London and Globe Company, both in the actions and in the settlement with the United Company, but independently; and we are now, as hitherto, carrying on our business independently.

Harrison, Cox-Walker & Co.

Darlington, *October 27th*, 1884.

If Mr. W. C. Barney will re-read my letter in your issue for October 18th, I think he will see that in writing the same I had no wish to deny the accuracy of his statement with regard to the date of the publication of the "Mechanic Receiver" in *Engineering*, but that I merely wished to give my authority for my own previous statement, which now appears to have been incorrect.

I regret that this should have been the case, but I think that Mr. Barney will agree with me in thinking that my authority was a good one.

I must thank Mr. Barney and your other correspondent, *Stat nominio umbra*, for the information that they have afforded, and will express a hope that they will also be good enough to bring forward their opinions as to the other matter contained in my letter in your issue for October 25th.

S.

October 25th, 1884.

Induction and the Telephone.

I have noticed when travelling by rail a certain number of telephone lines, the construction of which attracted my attention from appearing somewhat peculiar and different from what I have generally met with. Each post has alternately long and short cross-bars, carrying two, and in some cases four, wires each. The peculiarity referred to consists in each wire, at every post, being encircled by a stirrup of sheet iron about one inch broad. This may be the old hoop guard (from appearance I should say they were hoop guards) which used to be so common on all telegraph lines a few years back.

There is also a wire from the ground running up each post, dividing and distributing itself to each of the screws fastening the insulator and hoop guard in position. This wire is also joined up to another one running from post to post, and to all appearance seems continuous.

It is as to the possible utility of all this arrangement that I shall be glad if you can afford me any information. Can it be that "induction" is in any way lessened? Leakage, of course, would be carried off at the ground wires, but I do not see the function of the hoop guard, more especially as these have almost been discarded on telegraph lines.

I ought also to mention that the wires are run on the straight, *i.e.*, they maintain a continuous parallelism with regard to each other. I shall be glad of any information through the medium of your valuable paper.

"H. R. S."

Liverpool, *October 27th*, 1884.

The Electric Light for the Microscope.

In last week's number of your journal there appears an article headed "The electric light for use with the microscope," which seems to be based upon certain series of experiments recently made by the scientists of the Franklin Institute in the United States. These successful experiments are not a novelty by any means, and credit for such does not belong to the American scientists referred to, as you will admit.

We are the owners and originators of the giant electric microscope, and we have been very successful in our public demonstrations, having given 150 consecutive performances of "Les Invisibles" at the Théatre des Menus-Plaisirs, Paris, and since then exhibited with like success at the Crystal Palace, Sydenham, and the Imperial Theatre, Westminster.

The arc lamps used on these occasions referred to were of our own construction, and of no particular system; the dynamos, however, were of the Gülcher type.

For M. Bauer & Co.,
ALBERT FERDINAND LINK.

London, *October 25th*, 1884.

[We stated at the end of the note in question that the same experiments had been performed in this country.—EDS. ELEC. REV.]

The "Bell" and "Edison" Telephone Patents.

Your correspondent, "S.," seems very anxious to thoroughly understand what the above patents cover. That is no doubt a very laudable desire; but it might be as well to warn "S." and others that the United Telephone Company systematically enter actions against persons making or using any practical telephone. I may, with your permission, in a future number give you an account of their *modus operandi*, which will give your readers some idea of their action when fairly met.

"*Stat nominio umbra*" suggests that the United Telephone Company are afraid of their patents. I venture to say that never has a great monopoly been successfully maintained for such a length of time on such shallow grounds, and I venture to predict that if the United will only fight they will very shortly accomplish the "happy despatch."

The United threaten proceedings against all persons manufacturing, selling, or using any magneto telephone receiver, whilst the very patent upon which they rely specifically disclaims one. In addition to this, the Courts of Law have decided that there are three other magneto receivers which were known in this country before the Bell patent was applied for. Firstly, we have the Reis magneto receiver, which was a tongue of wood carrying a bar armature of soft iron. Then we have the "English mechanic" magneto receiver, consisting of a tympan of goldbeaters' skin carrying a disc or button of iron or steel. Then there is the "Glasgow" magneto receiver, which was a plate made wholly of iron, having a tongue movement. There is also the magneto receiver described in the Bell patent, and disclaimed, and which, as Major Barney has pointed out, was a stretched membrane, having a pin attached to its centre, and carried by an armature fixed to one pole of an electro-magnet. How then, Sir, do the United Telephone Company substantiate their monstrous claim? Further, let us see what their patent

(Bell's) really covers. The four instruments described above are admittedly outside the claims of the patent. We may therefore use a tongue of wood with a bar armature (Reis's); a tongue of iron (the "Glasgow"); a tympan of flexible non-inductive material with a disc of iron or steel fixed in the centre (the "English mechanic"); and a tympan of similar material actuated by a pin carried by a bar armature—the disclaimed instrument. All these may be used in combination with an electro-magnet, or its obvious equivalent, a permanent magnet. Now let us take the claims in the patent. They are ("subject to the disclaiming notes") for "the combination of a plate of iron or steel or other material capable of inductive action" with an electro or permanent magnet "substantially as set forth and described." As is well known, the claims of a patent (according to the patent law of this country) are not only to indicate what is *claimed*, but also what is *not* claimed. Whatever the patent may describe, what is not claimed, is not covered. Now the Bell patent disclaims a tympan (a membrane) not capable (of itself) of inductive action, and attached to an armature which is; but it claims a plate tympan made of material capable of inductive action in combination with a magnet. It follows, therefore, that a plate tympan *not* capable of inductive action is not claimed by the patent. The patent could not disclaim a tympan made of one description of material not capable of inductive action and still claim all others; and therefore the patent tells us that what is claimed is "a plate of iron or steel or other material capable of inductive action."

It is therefore not a matter of inference, of opinion, of probability or possibility, but a plain palpable fact that a tympan or tongue of non-inductive material carrying a disc or button of material which *is* inductive, or attached by a pin to a bar or tongue armature, and actuated by electro-magnetism, is outside the Bell patent. The United may rave and threaten as they choose, but let them dare to take such an instrument into Court (seriously defended), and they will unquestionably come out with their wings clipped.

And now with regard to a carbon transmitter. Your correspondent, "S.," says that there should be some species of surface on which the sound waves may be received, and suggests that all depends upon the interpretation of the terms tympan and diaphragm. I hope I am wrong, but this insidious suggestion seems to savour very much of the United Telephone Company. As "S." is doubtless aware, the United threaten proceedings against "*any form* of transmitter" in which carbon, or equivalent material, is employed. Of course they rely upon the Edison patent which, as you are aware, never once mentions the word "carbon." We will, however, concede that the term tension regulator means carbon current regulator. But conceding this much the Edison patent cannot cover more than it claims, which is the combination of a diaphragm with a tension regulator. Now the Hughes microphone (which is as superior to Edison's as Bell's receiver to Reis's) requires no diaphragm. But, as "S." says, there must be something. We will therefore turn to Edison's patent and take only what Edison tells us we may take. There are three principal and essential parts in Edison's instrument—a resonant case, a diaphragm, and a tension regulator. Originally the patent claimed the resonant case (claim 7), and the tension regulator pure and simple (claim 17), as well as the combination of the diaphragm and the tension regulator. But claim 7 and claim 17, amongst others, have since been disclaimed, and there only remains one claim covering the combination (the union) of the diaphragm with the tension regulator. We may therefore use a carbon tension regulator, and we may use a resonant case. Nay, the disclaimer tells us that we may, for after disclaiming these parts it ends thus:—

"I would observe, in conclusion, that I do not claim generally the transmission and reproduction of sounds by increasing and decreasing the resistance of the circuit, *nor do I claim separately any of the parts or arrangements hereinbefore described and illustrated in the accompanying drawings*, except as hereinafter mentioned—but I claim as my invention:—

"In an instrument for transmitting electric impulses by sound, the combination with a diaphragm or tympan, of electric tension regulators, substantially as hereinbefore described, for varying the resistance in a closed circuit, substantially as set forth."

Therefore, to be within the patent, the tension regulator must be used in combination with a diaphragm or tympan. It must be a tension regulator substantially as described, and it must in operation be in a closed circuit. Now the Hughes microphone does not require a diaphragm—it certainly is not described in the Edison patent—and I defy the United Telephone Company to prove that when in operation it forms part of a *closed* circuit.

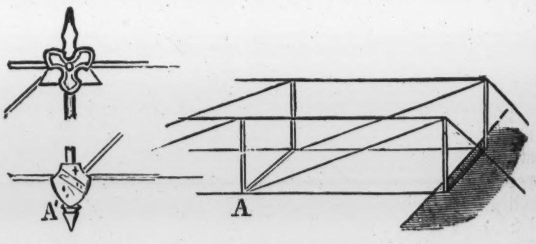
We may therefore use a resonant case (and we may make it as resonant as we please) and the Hughes microphone (or Edison's tension regulator) without infringing Edison's patent. So long as there is nothing to intercept the sound waves from the tension regulator there is no infringement. The United Telephone Company may boast, and threaten, and bluster, but let them go into Court against such an instrument, and if they win we will acknowledge their monopoly; but, until they do, I submit that the grounds upon which that monopoly is maintained are as weak as Messrs. Waterhouse and Winterbottom's threats.

F. T. H.

Derby, *October 27th*, 1884.

Overhead Wires in Cities.

With reference to Mr. Cracknell's letter in your issue of the 11th inst., if he will kindly refer to my communication of July 12th he will see I there stated my objection to his system to be that if applied to England we should not be so well justified in the expense of erecting these posts and friezes as our colonists in Australia are, where some support for the absolutely necessary awning is required; and in new localities probably some consideration might be received from the shopkeeper for the use of the Government erection to support their awnings, where these are permanent erections of corrugated iron. On the question of expense, however, Mr. Cracknell, with estimates and tenders before him, is better qualified to speak; but as regards protection from the danger of broken overhead wires, and also for removing the present unsightly appearance, I contend that such a construction as I proposed in the above-mentioned communication fulfils both conditions, and as Mr. Cracknell asks for further particulars, I send a line diagram in perspective of a portion of the cage which surrounds the wires (still suspended in mid-air), also a sketch of ornamental rosettes or covers to hide the connections, these being gilded. The whole cobweb of wires now promiscuously scattered would run in regular tiers within these cages, and the combined effect would be anything but unsightly, whilst all other parts of the street would be quite free.



The windlasses at each end, as will be seen from the former communication, are for replacing old wires without interfering with traffic beneath, they have an endless wire rope connecting them, so that by lashing one end of telegraph wire to same it can be passed easily through the frames.

C. Scott Snell.

London, *October 28th*, 1884.

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